

THE CAMBRIDGE DESCARTES LEXICON

The Cambridge Descartes Lexicon is the definitive reference source on René Descartes, “the father of modern philosophy” and arguably among the most important philosophers of all time. Examining the full range of Descartes’ achievements and legacy, the lexicon includes 256 in-depth entries that explain key concepts relating to his thought. Cumulatively they uncover interpretative disputes, trace his influences, and explain how his work was received by critics and developed by followers. There are entries on topics such as certainty, *cogito ergo sum*, doubt, dualism, free will, God, geometry, happiness, human being, knowledge, *Meditations on First Philosophy*, mind, passion, physics, and virtue, which are written by the largest and most distinguished team of Cartesian scholars ever assembled for a collaborative research project – ninety-one contributors from ten countries.

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EDITED BY

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J. A. Van Ruler, *Erasmus Universiteit Rotterdam*: Geulincx, Arnold; *Private Thoughts; The World*

Theo Verbeek, *Universiteit Utrecht*: Baillet, Adrien; Beverwijck, Johan Van; Brasset, Henri; Brégy, Nicolas Léonor Flesselles de; Buitendyck, Burman, Frans; Calvinism;

Caterus, Johannes; Chanut, Hector-Pierre; Clauberg, Johannes; Colvius, Andreas; *Comments on a Certain Broadsheet*; Correspondence (with Erik-Jan Bos); Experiment; Golius, Jacob; Heereboord, Adriaan; Hogelande, Cornelis Van; Huygens, Christiaan; Huygens, Constantijn; Luynes, Duc de; *Meteors*; Plempius, Vopiscus Fortunatus; Pollot, Alphonse; Regius, Henricus; Reneri, Henricus; Schoock, Martinus; *Search for Truth by the Natural Light* (with Erik-Jan Bos); The Stampioen Affair; *Treatise on Man* (with Erik-Jan Bos); Voetius, Gysbertus; Vorstius, Adolph

Thomas Vinci, *University of Dalhousie*: Body, Proof of the Existence of; Truth

Richard A. Watson, *Washington University*: Le Grand, Antoine; Transubstantiation

Mark Wilson, *University of Pittsburgh*: Machine

Abbreviations

The following abbreviations of editions of Descartes' works are used in this volume:

- AT *Oeuvres de Descartes*, 11 vols., ed. Charles Adam and Paul Tannery (Paris: Librairie Philosophique J. Vrin, 1996). Cited by volume number (roman) and page numbers (arabic) (e.g., AT VII 64).
- B *Descartes' Conversation with Burman*, trans. John Cottingham (Oxford: Clarendon Press, 1976). Cited by page numbers.
- CSM *The Philosophical Writings of Descartes*, vols. I and II, trans. John Cottingham, Robert Stoothoff, and Dugald Murdoch (Cambridge: Cambridge University Press, 1985). Cited by volume number (roman) and page numbers (arabic) (e.g., CSM II 44).
- CSMK *The Philosophical Writings of Descartes*, vol. III, trans. John Cottingham, Robert Stoothoff, Dugald Murdoch, and Anthony Kenny (Cambridge: Cambridge University Press, 1991). Cited by page numbers.
- G *The World and Other Writings*, ed. and trans. Stephen Gaukroger (Cambridge: Cambridge University Press, 1998). Cited by page numbers.
- H *Treatise of Man: René Descartes*, trans. and ed. Thomas Steele Hall (Cambridge, MA: Harvard University Press 1972). Cited by page numbers.

- MM *Principles of Philosophy*, trans. Valentine Rodger Miller and Reese P. Miller (Boston: D. Reidel, 1983). Cited by page numbers.
- O *Discourse on Method, Optics, Geometry, and Meteorology*, trans. Paul J. Olscamp. Library of Liberal Arts (New York: Bobbs-Merrill, 1965). Cited by page numbers.

Passages from the English translations in the preceding list are typically quoted verbatim, but contributors to this volume sometimes deviate from these in order to stress particular points of interpretation. In addition to the editions in the preceding list, citations from some works such as the *Principles of Philosophy* are sometimes made to the original part (roman) and article number (arabic), separated by a period (e.g., *Principles* I.34).

The eleven volumes of AT contain the authoritative edition of Descartes' writings in the original French and Latin. The combined three volumes of CSM and CSMK contain the standard English translations of Descartes' works. (Note: the translators use diamond brackets [<, >] to distinguish material added in the French translation from the original Latin and daggers [†, ‡] when translating French in a Latin context or vice versa.) Most citations in this volume are from AT and CSM(K), but the authors of the scientific entries sometimes cite G, MM, or O, instead of CSM(K), since these translations of works such as *The World*, the *Treatise on Man*, and the *Principles of Philosophy* are more complete.

For ease of reference, Descartes' main writings can be found in the following volumes of AT and CSM(K):

AT I–V, X	CSMK	Correspondence
AT V	CSMK	<i>Conversation with Burman</i>
AT VI	CSM I	<i>Discourse on Method</i> and “Essays” (see O for complete translations of <i>Dioptrics</i> , <i>Geometry</i> , and <i>Meteors</i>)
AT VII	CSM II	<i>Meditations on First Philosophy</i> and <i>Objections and Replies</i> (Latin)
AT VIIIA	CSM I	<i>Principles of Philosophy</i> (Latin) (see MM for complete translation)
AT VIIIB	CSM I	<i>Comments on a Certain Broadsheet</i>
AT IXA	CSM II	<i>Meditations on First Philosophy</i> and <i>Objections and Replies</i> (French)
AT IXB	CSM I	<i>Principles of Philosophy</i> (French)
AT X	CSM I	<i>Rules for the Direction of the Mind</i>
AT X	CSM II	<i>Search for Truth by the Natural Light</i>
AT XI	CSM I	<i>The World</i> (or <i>Treatise on Light</i>), <i>Treatise on Man</i> , <i>Description of the Human Body</i> , <i>Passions of the Soul</i> (see G for complete translations of first three works)

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Introduction and Notes on How to Use This Work

René Descartes (1596–1650) is the most important French philosopher who ever lived and, arguably, among the top five philosophers of all time. He is known as “the father of modern philosophy” in part because of the influence he continues to exert over the way the discipline is practiced. But he was much more than a philosopher; he was a universal genius whose writings range over anatomy and physiology, astronomy, biology, epistemology, ethics, mathematics, medicine, metaphysics, meteorology, music, optics, psychology, and physics. There is a very long tradition of Cartesian studies but over the past thirty years there has been an explosion of academic works devoted to Descartes’ ideas, and the rate of production is accelerating. An insatiable appetite for all things Cartesian is being fed by a steady diet of new monographs, guidebooks, biographies, anthologies of essays, translations, journal articles, and other scholarly works. One of the primary aims of this volume is to help the reader digest this vast literature, while also introducing him or her to the breadth of Descartes’ thought.

The *Cambridge Descartes Lexicon* is more like an encyclopedia or a compendium than a traditional dictionary, both in its scope and in its content. Many of the entries are fairly lengthy, especially those devoted to important subject terms such as “*Cogito Ergo Sum*,” “Free Will,” “God,” “Human Being,” “Idea,” “Law of Nature,” and “Representation.” Most of the subject entries are also “scholarly” in the sense that they introduce readers to debates in the secondary literature. The authors of these entries sometimes present these debates without defending their own views, but in many cases they take an interpretive stand. Authors of overlapping entries were encouraged to stake out opposing positions (see, e.g., “Body,” “Individuation,” and “Substance”). The result is that by reading just a few pages readers can familiarize themselves with almost any given scholarly dispute and get a sense of the arguments and textual evidence for various interpretations.

In perusing the *Lexicon*, readers will find articles on all of the familiar topics, such as “Certainty,” “Clarity and Distinctness,” “Doubt,” “Dualism,” “Geometry,” “Knowledge,” “Method,” and “Mind,” as well as entries on several unexpected and perhaps unfamiliar topics such as “Language,” “Physico-Mathematics,” “Rosicrucian,” and “The Stampioen Affair.” Among the subject entries, preference was generally given to topics that are broader and more encompassing, so that authors would be able to probe more deeply, but great efforts were also made to ensure comprehensiveness. There is a wealth of terms devoted not just to Descartes’ philosophy in the contemporary sense of that term but also to his scientific work, such as “Anatomy and Physiology,” “Animal,” “Body,” “Cosmology,” “Experiment,” “Explanation,” “Force and Determination,” “Gravity,” “Heart,” “Hydrostatics,” “Inertia,” “Machine,” “Mechanics,” “Optics,” “Physics,” and “Vortex.” Given the recent interest in Descartes’ ethics and treatment of the passions, readers will also be pleased to find entries such as “Habit,” “Happiness,” “Passion,” “Pineal Gland,” and “Virtue.” Those who are curious about Descartes’ religious commitments and about the relation between his philosophy and various theological doctrines and movements should consult “Calvinism”; “Faith, Religious”; “Jansenism”; “Jesuit”; “Oratorian”; “Pelagianism”; “Soul, Immortality of the”; and “Transubstantiation.” The theological controversies he faced at Utrecht and Leiden are detailed in the entries “Heereboord, Adriaan”; “Regius, Henricus”; “Schoock, Martinus”; and “Voetius, Gysbertus”; and in the biography at the beginning of the volume.

In addition to the 149 subject entries – which include articles on Descartes’ individual works such as the *Discourse on Method* and the *Principles of Philosophy* – there are 107 intellectual biographies of various figures, including official objectors to the *Meditations* such as Arnauld, Gassendi, and Hobbes; notable contemporaries and immediate successors such as Leibniz, Locke, Newton, and Spinoza; medieval and Scholastic predecessors such as Augustine, Aquinas, Eustachius, Scotus, and Suárez; important correspondents such as Princess Elisabeth, Constantijn Huygens, and Mersenne; and followers such as Desgabets and Régis. The intellectual biographies briefly sketch each figure’s life and accomplishments and then discuss the relation of that person’s thought to Descartes’. They also trace Descartes’ influences, record the reception of his ideas by critics, and discuss the ways in which his acolytes developed or adapted his views. All of the entries are written in a lucid style and thus accessible to a wide audience, including philosophers generally, those working in related disciplines, and students. Written by the largest and most distinguished team of Cartesian scholars ever assembled for a collaborative research project (ninety-one contributors from ten countries), the *Cambridge Descartes Lexicon* aspires to serve as the definitive and most comprehensive reference source on Descartes and Cartesianism.

This volume also contains the following resources:

- **Bibliographies:** Each entry includes a short list of suggested sources (where relevant, both primary and secondary) to help facilitate further research.
- **Biography and Annotated Bibliography:** The biography is intended to give readers a broad sense of Descartes' ambitions, character, and motivations and to discuss the challenges that he faced. It includes an annotated bibliography for those interested in investigating Descartes' life further.
- **Cross-References:** The entries in this lexicon are meticulously cross-referenced. The first time an entry is mentioned within the body of another, it is highlighted in bold. There is also a select list of the most important cross-references at the end of each entry ("*See also ...*").
- **Translations:** Many of the entries quote liberally from Descartes' writings, and most refer to passages from his works. For a quick reference guide linking Descartes' works in the canonical original-language edition (by Adam and Tannery) to various English translations, see the Abbreviations page.
- **Index:** To enhance usability, the volume includes a detailed index.

Chronology

- 1596 Born March 31 in the village of La Haye (now Descartes), south of Tours.
- 1597 Mother dies in childbirth.
- 1600 Father remarries and relocates to Rennes (Brittany), leaving Descartes and his siblings Jeanne and Pierre to be raised by their maternal grandmother.
- 1607–15(?) Attends the recently founded Jesuit Collège Henri IV de La Flèche, where he studies the classics and is steeped in Scholasticism.
- 1615–16 Studies law, earning a *baccalauréat* and *licence* in civil and canon law at University of Poitiers.
- 1616–18 Likely resides in Paris.
- 1618 Travels to Holland to join the army of Prince Maurice of Nassau, fighting for Dutch independence from Spain; befriends Isaac Beeckman, with whom he collaborates in applying mathematics to problems in physics; writes *Compendium of Music* as gift for Beeckman; begins keeping a notebook whose main surviving part is known as *Private Thoughts*.
- 1619 Travels to southern Germany to join the army of Maximillian of Bavaria in the second year of the Thirty Years' War; has three life-changing dreams that purportedly inspire him to implement his vision of a universal science based on mathematics. Begins writing *Rules for the Direction of the Mind*.
- 1620–25 Travels widely, including perhaps a pilgrimage to Loretto, Italy.
- 1622 Returns to France; inherits part of his mother's estate, which together with a later inheritance from his father, enables him to devote his life to research and writing.

- 1625–28 Resides in Paris, where he meets several intellectuals who will become important correspondents; likely meets Mersenne, who becomes his chief correspondent and most important promoter.
- 1627 Impresses Cardinal Bérulle, who urges him to publish his new philosophy.
- 1628 Abandons the *Rules*, which was published unfinished in Dutch (1684) and in Latin (1701), though multiple manuscripts with subtle differences survive, including one recently discovered. Begins optical experiments and discovers sine law of refraction; begins anatomical investigations that lead him to articulate the *bête machine* doctrine, according to which animals are mere automata, lacking sentience and thought.
- 1629 Emigrates to Holland where he spends the next twenty years living as a peripatetic recluse, seeking solitude and religious toleration to complete his revolutionary work. Envisages a short treatise on metaphysical topics, such as the existence of God and the immortality of the soul, which are later developed in the *Discourse* (1637) and more fully in the *Meditations* (1641). Begins working on *The World*; what originally focused on meteorological phenomena expands to include “the whole of physics.”
- 1633 Fearing persecution from the Catholic Church after learning of Galileo’s condemnation, withholds publication of *The World*, one of his most ambitious works in which he advocates a form of Copernicanism.
- 1635 Descartes’ daughter Francine is born August 7 to Helene Jans, a maid.
- 1637 Publishes first work, *Discourse on Method* and accompanying “Essays” (*Dioptrics*, *Meteors*, and *Geometry*), in French (Latin edition 1644), demonstrating the fecundity of Cartesian method. The *Discourse* proper is intended as a preface to his scientific project, but its autobiographical and conversational style elevates it to one of his most important works and a prelude to the *Meditations*; becomes a model of modern French philosophical prose.
- 1637–39 Descartes invites objections to the *Discourse* and this leads to a lively correspondence and whets readers’ appetite for his metaphysics and physics.
- 1640 Daughter Francine dies in August of scarlet fever at age five; Descartes expresses sorrow but resumes his work in keeping with view that it would be “dishonorable to abandon oneself to grief.” His father and sister die in the fall.
- 1641 Publishes in Latin *Meditations on First Philosophy* (often regarded as his magnum opus), with the first six sets of Objections and Replies. The objections are written by theologians such as Mersenne and notable philosophers such as Hobbes and Gassendi.

- 1642–43 The Quarrel at Utrecht: Descartes' protégé Regius, a professor of medicine at the University of Utrecht, incites the ire of the school's rector Voetius, who, along with his surrogate Schoock, accuses Descartes of atheism and Pelagianism. Descartes seeks protection from the French ambassador, who convinces the Prince of Orange to intervene, but his philosophy is banned.
- 1642 Publishes second edition of *Meditations*, with all seven sets of Objections and Replies and the Letter to Father Dinet. Descartes mistakenly assumes that Pierre Bourdin, whose Seventh Set of Objections is particularly harsh, speaks for the whole Jesuit order and complains to Dinet, Bourdin's superior; uses Letter as opportunity to vilify Voetius.
- 1643 Begins lengthy and important correspondence with Elisabeth, the exiled Princess of Bohemia, who first raises the problem of mind-body interaction, seeks his aid in relieving her depression, and inspires him to write the *Passions of the Soul*.
- 1644 Publishes *Principles of Philosophy* – his most comprehensive work in philosophy and science – which he dedicates to Elisabeth; his hope that it would replace Scholastic textbooks in Jesuit schools is frustrated. Returns to France for first time in fifteen years.
- 1646–47 The Utrecht controversy is replayed at the University of Leiden when Heereboord defends Descartes' method. Heereboord's theological colleagues accuse Descartes of skepticism and atheism, and the Prince of Orange again intervenes.
- 1647 Repudiates Regius's physics in preface to the French edition of *Principles* and offers a point-by-point critique of his response in *Comments on a Certain Broadsheet*. Begins work on embryology in *Description of the Human Body* (published posthumously).
- 1648 Interviewed by Frans Burman, a bright Dutch student who asks difficult questions about specific passages in Descartes' corpus, resulting in the *Conversation with Burman*; University of Leiden bans the teaching of his works; efforts to obtain pension from King of France fail.
- 1649 Travels to Sweden to teach philosophy to Queen Christina and perhaps to escape the religious controversies faced in Holland but regrets decision soon after arrival; publishes *Passions of the Soul*, which contains some of his most mature thoughts on physiology and explores psychological and ethical topics not treated in earlier works.
- 1650 Dies of pneumonia in Stockholm on February 11.

Descartes' Life and Works

1. Childhood and Education
2. Travels and Search for a Career
3. Early Writings on Method and Science
4. The *Discourse on Method* and “Essays”
5. *Meditations on First Philosophy*
6. The Theological Controversies at Utrecht and Leiden
7. Correspondence with Princess Elisabeth
8. The *Principles of Philosophy*
9. *Comments on a Certain Broadsheet* and the Rift with Regius
10. *Conversation with Burman*
11. Sweden: “A Land of Bears, Rocks, and Ice” – and Death

I. CHILDHOOD AND EDUCATION

René Descartes was born March 31, 1596, in La Haye, a French village in the Touraine that now bears his name, though his family home was sixteen miles away in Châtellerault (in the Poitou region). His mother Jeanne died in childbirth when he was just thirteen months old, though he mistakenly believed that she succumbed to a lung ailment a few days after his birth. He claims to have inherited from her “a dry cough and a pale color ... so that all the doctors condemned me to an early death.”¹ Descartes hailed from a family of doctors, lawyers, and tax collectors. Thus they were members of the

¹ AT IV 220–21.

gentry, on their way to becoming ennobled, though as an adult Descartes presented himself as a nobleman and was regarded as such in at least some circles.² His father Joachim was a lawyer and a councilor of the Parlement of Brittany, and so was absent from the family several months out of the year, including the period of Descartes' birth. Joachim remarried a few years after the death of Descartes' mother and relocated closer to Rennes, the seat of parlement, leaving the future philosopher and his older siblings Jeanne and Pierre to be raised by their maternal grandmother in La Haye. This may be the reason why Descartes was estranged from his father as an adult. Not much is known about Descartes' early childhood, but there are many improbable legends, such as that he was born in a ditch in front of a farm while his mother was en route to La Haye, a story that likely originates in the rivalry between residents of Touraine and those of Poitou, each of whom wanted to claim him as their own.³ One thing we do know with some certainty is that he was sickly and that his grandmother (and wet nurse) exerted a greater influence on him during this time than anyone else.

In about 1607, when he was eleven years old, Descartes was sent away to study at the newly formed Jesuit Collège de La Flèche in Anjou, some eighty miles away from home.⁴ The Jesuits were known for the quality of their teaching institutions and created several colleges in France by approval of King Henry IV, who had donated funds and a palace for the construction of La Flèche, helping to ensure that it would become the best of its kind – in Descartes' words, “one of the most famous schools in Europe.”⁵ Henry's association with the college was made complete when, in 1610, after being struck down by an assassin, his heart was carried from Paris to La Flèche in a grand funeral ceremony in which Descartes participated.

The Jesuits followed a standardized curriculum known as the *Ratio Studiorum* (Plan of Studies), which consisted of five years of classical Latin and Greek grammar and literature, followed by three years of “philosophy” – consisting of logic, mathematics, physics, metaphysics, and ethics.⁶ Much of the philosophical curriculum was based on commentaries on Aristotle, as interpreted by Saint Thomas Aquinas and other Scholastics, known as *Conimbricenses*. Although the curriculum was highly regimented and students followed a strict daily schedule beginning with prayers at five o'clock, La Flèche and other Jesuit colleges were liberal by comparison to earlier

² Rodis-Lewis (1999, 2) notes that Descartes' family received letters of chivalry (the first degree of nobility) in 1668 (eighteen years after Descartes' death), which would have been hastened had Descartes chosen the same career as his father. But Theo Verbeek informs me that in the United Provinces Descartes was referred to in his own lifetime as *vir nobilis* (nobleman).

³ If his mother had been en route to La Haye, then this would have likely placed his birth in Poitou rather than in Touraine. See Rodis-Lewis 1999, 3.

⁴ There is uncertainty about the exact year when Descartes began his studies at La Flèche. It may have been a year or two earlier. His brother Pierre started in 1604, the year the school opened.

⁵ AT VI 5, CSM I 113.

⁶ The term “philosophy” was used more broadly than it is today.

educational institutions, which were monastic in character. Among other things, the Jesuits allowed students more private time and encouraged them to play games and produce plays.⁷ It is thought that because of his sickly disposition and his family relation to Father Charlet, the rector of the school, Descartes was afforded a private room and allowed to study in bed and not rise until late in the morning, a practice that he purportedly continued in adulthood.⁸ He would later praise Charlet as his surrogate father.⁹

Although Descartes adored and respected his teachers, he despised the philosophical education that he received at La Flèche, steeped as it was in Aristotelian Scholasticism. It is sometimes said that the Jesuits were the main instrument of the Catholic Counter-Reformation and their teaching institutions the means for instilling Christian virtues and rooting out heresies.¹⁰ The Jesuits regarded students as repositories for Catholic orthodoxy, thus contradicting the Platonic conception of learning to which Descartes would later subscribe: the mind already contains the “seeds of knowledge” in the form of innate ideas that can be clearly and distinctly perceived once one’s mind is freed of preconceived opinions. On this view, which Descartes would develop in works such as the *Meditations on First Philosophy* (1641), reason is its own guide, and the truth is to be found within one’s mind, not outside it in historical authorities or tradition. As a result of educational reforms of the Council of Trent (1545–63), the Jesuits were also bound by official church prohibitions against espousing novel opinions. The founder of the Jesuit order, Saint Ignatius of Loyola, specifically urged his followers to adhere to the teachings of Aquinas in theology and those of Aristotle in philosophy. This advice was codified in the *Ratio Studiorum* (1586): “In logic, natural philosophy, ethics, and metaphysics, Aristotle’s doctrine is to be followed.”¹¹ There was a loosening of these restrictions in Descartes’ day, especially in metaphysics and science, and in fact the Jesuits were much more open-minded than some and even enthusiastic about many of the new discoveries that were made in these early days of the Scientific Revolution. For example, in 1610 Galileo observed four of Jupiter’s moons through a telescope – a recent invention – and the fathers at La Flèche organized a celebration and encouraged students to write poetry praising the discovery. Nevertheless, the conservative character of earlier reforms would pose a serious obstacle to Descartes’ revolution in philosophy that took Aristotelian Scholasticism as its main target.¹²

⁷ Gaukroger 1995, 42–43.

⁸ Baillet 1691, I 28, 153–54.

⁹ AT IV 221.

¹⁰ François de Dainville, *L’Education des jésuites* (Paris, 1978), 16; cited in Gaukroger 1995, 39; cf. Clarke 2006, 28.

¹¹ C. de Rochemonteix, *Un collège des Jésuites au XIII^e et XIII^e siècle: Le collège Henri IV de la Flèche* (Le Mans, 1899), 8 n.; cited in R. Ariew, *Descartes among the Scholastics* (Boston, 2011), 20.

¹² For a fuller treatment of the original educational reforms and their liberalization among the Jesuits in later years, see Ariew 2011, 19–26.

Having finished the equivalent of secondary school and college, Descartes left La Flèche in 1614 or 1615 and went on to study law at the University of Poitiers, following the model set by his father and his brother. But after graduating in 1616 with an advanced degree, he was at a loss as to what career to pursue. In fact, he would agonize over this question for several years. The most natural course would have been to practice law and become a member of parlement like his father and his brother or, if not one of these, take up some other vocation of the gentry, such as teaching or medicine. But Descartes had higher ambitions, even if at this point he did not know how to realize – or even how to specify – them. He would later receive a modest inheritance from each of his parent's estate that enabled him to dedicate the latter half of his life to philosophical and scientific pursuits, but at this point in his early adulthood he needed to support himself.

2. TRAVELS AND SEARCH FOR A CAREER

In the autobiographical sketch in the *Discourse*, Descartes gives us a sense of his state of mind at this point in his life: while granting that he had learned much from his studies at La Flèche that was of practical importance, he had grown dissatisfied with “the study of letters” and decided to seek knowledge instead from “that which could be found in myself or in the great book of the world.”¹³ He thus began several years of extensive travel as a gentleman officer in the army. It was not unusual for a man of his social station and education to join the military, especially given the position he occupied within his family. An office in parlement was very expensive, and his family may have already exhausted its resources obtaining his older brother's office in Brittany and on his older sister, who was provided with a handsome dowry when she married into nobility. In Descartes' time, the youngest son was often forced to choose between the church (which cost virtually nothing) and the army (which cost more but much less than the judiciary). He would have found life among the clergy too confining, and given his mathematical talents, already recognized at La Flèche, a career in the military offered the hope of applying geometry to engineering and logistical problems. In any case, he had overcome the frailties of his youth but was still an unlikely soldier. We do not know whether he ever saw combat, though he appears to have been more of a tourist than a soldier, using his travels as an opportunity to interact with scientists and other intellectuals, and to bear witness to important historical events, such as the coronation of Emperor Ferdinand II in Frankfurt:

I spent the rest of my youth travelling, visiting courts and armies, mixing with people of diverse temperaments and ranks, gathering various experiences, testing

¹³ AT VI 9, CSM I 115.

myself in the situations which fortune offered me, and at all times reflecting upon whatever came my way so as to derive some profit from it.¹⁴

The vast parts of Europe he discovered would have been very different from the “gardens of Touraine” where he had spent his idyllic, albeit sheltered, childhood.¹⁵ The year he set out on his journey just so happened to mark the beginning of the Thirty Years’ War, one of the most devastating wars in European history, but fortunately he survived unscathed. During his travels he reveled in the diversity of customs and opinions he encountered. He compared these with the differences of opinion among the Scholastics whom he had studied at La Flèche and then drew an important lesson that would inform his philosophy: “I learned not to believe too firmly anything of which I had been persuaded only by example and custom. Thus I gradually freed myself from many errors which may obscure our natural light and make us less capable of heeding reason.”¹⁶

In 1618 Descartes began his military career by traveling to Breda in the United Provinces of the Netherlands to join the army of Maurice of Nassau, Prince of Orange, who led the Dutch fight for independence from Spain. He arrived in the middle of a long truce, which gave him the leisure to pursue other interests. There he met the Dutch scientist Isaac Beeckman (1588–1637), who became his close friend, mentor, and collaborator. Beeckman was seven years older than Descartes and had considerably more scientific background and experience, but he was impressed with Descartes’ superior mathematical abilities. Beeckman convinced Descartes that natural phenomena should be explained in terms of the microcorpuscular constitution of things. They were kindred spirits in thinking that physics and mathematics should be combined, a field they dubbed “physico-mathematics.” Together they attempted to solve problems concerning hydrostatics, musical theory, and the acceleration of bodies in free fall. The two men were extremely close; in one of his letters to Beeckman, Descartes speaks of “an unbreakable bond of affection” (AT X 153, CSMK 1), as a sign of which he presented his friend with the gift of a short treatise, *Compendium of Music*, which developed a mathematical theory of musical harmonies. But Descartes insisted that his gift “remain forever in the shadows of your study” (AT X 141). Following Beeckman’s lead, he also began keeping a notebook whose main surviving part has come to be known as *Private Thoughts*, where we learn about Descartes’ early love of poetry, his dabblings in the occult, and his early writings in mathematics.¹⁷

¹⁴ Ibid.

¹⁵ AT V 349, CSMK 375.

¹⁶ AT VI 10, CSM I 116.

¹⁷ See Amir Aczel, *Descartes’ Secret Notebook* (New York, 2005); Pierre Costabel, *René Descartes – Exercices pour les éléments des solides* (Paris, 1987); and Henri Gouhier, *Les premières pensées de Descartes*, 2nd ed. (Paris, 1979).

The degree of affection that Descartes had for Beeckman was matched by his bitterness toward him ten years later. In 1629 Beeckman shared parts of the *Compendium* with Marin Mersenne, another of Descartes' friends. When Descartes discovered this, he was livid and demanded that the work be returned. He was angry not only because Beeckman had breached his trust by sharing something that he had asked be kept private but also because he believed Beeckman was claiming credit as his mentor. Descartes responded sarcastically that he had also learned from ants and worms!¹⁸ The two men eventually reconciled, but their relationship remained strained. This incident is just one of many that reveal how defensive and proud Descartes could be about the originality of his genius. His self-image was of a solitary thinker who had rejected past learning and turned inward to determine what could be discovered about the world using only the resources of his own mind. This view of himself is also reflected in his reluctance to credit previous philosophers in his writings when adapting their ideas and in his refusal to meet some of the leading scientists of his day, such as Galileo. Descartes would later react similarly toward others who he believed breached his trust, but it should be noted in fairness that he could also be forgiving of his friends, grateful for their generosity, and willing to come to their aid when necessary.

Descartes did not stay long in the United Provinces, traveling in 1619 to join the army of Maximilian I, Duke of Bavaria, in southern Germany. It was here, on the cold and blustery night of November 10 while ensconced in his stove-heated room, that he had three famous dreams. He had gone to bed with much enthusiasm, having reflected earlier that day on "the foundations of a marvelous discovery."¹⁹ He interprets the dreams as a sign from God that he should dedicate himself to this new project, but what exactly did he discover? In the *Discourse on Method* (1637) and elsewhere, Descartes suggests that he had found a universal method inspired by mathematics for solving all manner of problems in philosophy and science, but recent biographers take this to be a retrospective reconstruction and are skeptical of the claim that his later thought can be traced to a single epiphany in 1619. If that were true, they argue, then why did he produce so little work over the next nine years? It is not until the end of the 1620s that he formulated a clear vision that would culminate in works such as *The World*, the *Discourse* itself, and the *Meditations*.²⁰

Descartes abandoned his military career by 1621 but continued to travel widely over the next few years. The details are obscure, but his destinations likely included Bohemia, France, Holland, Italy, and Switzerland and may have included a pilgrimage

¹⁸ AT I 156; cf. AT I 155–59.

¹⁹ AT X 216; cf. AT X 181.

²⁰ See esp. Clarke 2006, 61–62, 66; Rodis-Lewis 1999 and Roger Ariew, "Descartes and Scholasticism: The Intellectual Background to Descartes' Thought," in *The Cambridge Companion to Descartes*, ed. J. Cottingham (Cambridge, 1998), 58–63.

to Loretto. Descartes' early biographer, Adrien Baillet, tells a dramatic story about how, upon his return to Holland from Germany in the early 1620s, Descartes committed an act of heroism that saved his and his valet's lives. Descartes was crossing the Elbe River when the sailors onboard his vessel conspired to rob and kill him and throw his body overboard. They mistook him for a foreign merchant and presumed that he was carrying a lot of cash, but they also did not realize that he understood what they were saying to each other. Before their criminal intentions could be implemented, he rose to his feet suddenly, drew his sword, and – speaking in their native tongue in a fearsome tone – threatened to kill them. Baillet concludes: “It was upon this occasion that he perceived what effect the resoluteness of a man has on such pitiful low-spirited souls.”²¹ Descartes had practiced fencing at La Flèche, and this encounter (though it may be apocryphal) may have confirmed his view that what he learned there had some practical value despite its outmoded curriculum.

In 1622 Descartes turned twenty-six, making him old enough to collect his share of the inheritance from his mother's side of the family. So he visited his family in Rennes and took possession of several properties, most of which he sold immediately. One of them, the fief of Perron, had earned him the title *Seigneur du Perron* (Lord of Perron), which he continued to use even after the sale (to indicate his alleged nobility). He spent the years 1625–28 primarily in Paris, where he met several distinguished thinkers, many of whom would later become his correspondents, including Jean-Louis Guez de Balzac (an essayist), Jean de Silhon (Cardinal Richelieu's secretary, who wrote antiskeptical works and anticipated Descartes' *cogito*), Guillaume Gibieuf (an Oratorian priest who wrote a book on free will), Jean-Baptiste Morin (an astrologer, mathematician, and defender of Aristotle), and Étienne de Villebressieu (an engineer and friend who lived with Descartes and worked closely under him on optical experiments). He also likely met Marin Mersenne for the first time. Mersenne (1588–1648) was a member of the Catholic Order of Minims and spent the bulk of his adult life writing and editing works of mathematics, music, and theology; engaging with prominent philosophers; and promoting and facilitating the work of several scientists, especially Galileo and Pascal. Mersenne knew many of the important intellectuals of his day and carried on a vast correspondence. As such, he became indispensable to Descartes' career. After 1629, Mersenne was Descartes' chief correspondent and acted as a kind of clearinghouse – facilitating the exchange of letters between Descartes and other correspondents, assisting in the publication of some of his works, informing him of the latest scientific discoveries, and providing other services. Thanks to Mersenne and other admirers, Descartes began to acquire a reputation as a genius with new ideas and was besieged with visitors seeking his attention. He eventually grew tired of this fame, as the unsolicited visits interfered

²¹ Baillet 1691, I 102–3.

with his work. He decided to move to the outskirts of Paris but soon discovered that this was not far enough.²²

A momentous event occurred in Descartes' life in 1627 when he, along with Cardinal Pierre de Bérulle, Mersenne, and others, attended a lecture given by a chemist named Chandoux, who argued that Scholasticism should be replaced with a new system of philosophy that he had devised. When urged by others to share his opinion of the speech, Descartes – the only one in attendance who did not applaud – commended Chandoux's eloquence and anti-Scholasticism but then mounted a thoroughgoing refutation of his claims and recommended his own mathematical method for solving problems as an alternative. Bérulle, who founded the Oratory as a rival Catholic order to the Jesuits, was so impressed with Descartes' intellectual prowess that he visited him a few days later and said that it was his God-given duty to publish his views on medicine, physics, mechanics, and other fields so that humanity could benefit by way of improved health and reduced labors.²³ According to Baillet (who almost certainly embellished parts of the story), Bérulle's encouragement strengthened Descartes' resolve to leave France for the United Provinces (what is now the Netherlands), where he believed he might find the solitude necessary to complete his work. So, after visiting his family in Brittany in 1628, Descartes made the move in 1629 to the Netherlands, where he would spend most of the next twenty years of what was to be a rather reclusive life. Once there, Descartes continued his peripatetic ways, moving frequently from one Dutch town to another, though this time less to evade visitors than to follow friends, be closer to publishers, and evade outbreaks of the plague.²⁴ He also received his mail at alternative addresses to hide his exact whereabouts. In some circles he was given the nickname "Monsieur d'Escartes," a pun on the French word *escarté* (meaning "remote" or "isolated").

But solitude was probably not the only thing he was seeking in choosing to live abroad. The Catholic Counter-Reformation was alive and well in France, and one could be persecuted for advocating the sort of novel opinions that Descartes would soon espouse. A freethinker and philosophical naturalist named Vanini had been burned at the stake in Toulouse in 1619 for his alleged atheism and homosexuality. In Paris, the occultist Jean Fontanier was executed in 1622, and the poet Théophile de Viau was tortured and banished after nearly being executed in 1623 for his licentious writings and alleged libertinism. From Descartes' perspective, perhaps the most chilling act of repression occurred in 1624, when three anti-Aristotelians – Jean Bitauld, Étienne de Claves, and Antoine Villon – planned to debate publicly fourteen theses against Aristotle. The advertised event drew hundreds of spectators but was banned right before it occurred by the Parlement of Paris, which also issued

²² See AT I 5.

²³ Baillet 1691, I 164–66. Descartes briefly describes the event himself at AT I 213, CSMK 32 (excerpts).

²⁴ Watson 2002, 164–65.

a warning that any future challenges to authority would be punishable by death. Descartes tended to be much more cautious and calculating than all of these thinkers. Still, he planned ultimately to publish and disseminate his views widely and so was in danger of suffering a similar fate.

In contrast to France, the religious atmosphere in the Netherlands was more relaxed, or so it would seem. Ironically, in the decades to come, Descartes would find himself embroiled in the most heated religious controversy of his life – *with Protestants*, some of whom were as wedded to traditional learning as Catholics. It might be suspected that Descartes moved to the United Provinces because he converted to Protestantism. After all, his later philosophy – with its rejection of authority and emphasis on what can be known by looking within one's own mind – has a greater affinity to that branch of Christianity than it does to Catholicism. But based on the preponderance of evidence that we have, this suspicion seems unfounded. There is every indication that Descartes remained faithful to his baptismal religion, even if he wished that the Catholic Church practiced greater toleration.

3. EARLY WRITINGS ON METHOD AND SCIENCE

Between 1618 and 1633, Descartes engaged in several mathematical, philosophical, and scientific projects. But most of the works that he began were left unfinished and published only posthumously either because he was unsatisfied with them or because he recognized that they would offend the church. His search for a universal method informs the *Rules for the Direction of the Mind*, in which he speaks famously of a *mathesis universalis*. He intended the work to have three parts, each part consisting of twelve “rules,” but what survives are only the first eighteen rules and the titles for Rules 19–21, as he appears to have abandoned the project. He wrote and revised the *Rules* off and on from 1619 to 1628. The work is particularly useful for understanding Descartes' theory of logical inference, which is nonformal, unlike the Aristotelian syllogism. The *Rules* accords a greater role to the imagination in discovering the truth than do later works, which tend to stress the intellect or reason, but there also are anticipations of later concepts, such as the notion of clear and distinct perception. Many commentators have speculated as to why Descartes ultimately abandoned the *Rules*, which was listed on the inventory of his papers at his death in 1650 but not published until 1684 (Dutch) and 1701 (Latin). One common suggestion is that he realized that his project was lacking the requisite metaphysical foundation of the sort that he later provides in the *Meditations*. A more likely explanation is that he discovered that not all problems can be reduced to mathematical ones and that his ambition of finding general rules that could solve all possible problems in the sciences was naïve and overreaching.²⁵

²⁵ Clarke 2006, 86–87, 91.

Ever since meeting Beeckman in 1618, Descartes had attempted to solve problems in geometry, such as the problem of constructing mean proportionals and (later) the ancient Pappus problem. This work continued in the 1620s and beyond, but in the late 1620s he put aside mathematics temporarily and turned to scientific investigations in optics, anatomy and physiology, and astronomy and of atmospheric phenomena such as rainbows, wind, rain, and tides. As a result of experimenting with lenses, he was able to formulate the sine law of refraction (independently of Snell), which explains the behavior of light when it passes from one medium to another (e.g., from air to water). Here, he was helped (and later rivaled) by his wealthy friend Claude Mydorge, a mathematician who paid to have various lenses made for Descartes and introduced him to Jean Ferrier, a skilled lens grinder. In 1630 Descartes also began to frequent his local butcher in Amsterdam in order to learn how to dissect animals and to procure carcasses to study their anatomy.²⁶ Many years later, a visitor to Descartes' home asked to see his library. He must have been surprised when Descartes took him to a shed and showed him a dead calf that he planned to dissect.²⁷ In the *Discourse*, he professes to have developed in his youth a love of ancient authors, but now animal carcasses were his "books."²⁸ Descartes' anatomical investigations led him to formulate the notorious *bête-machine* doctrine, according to which animals are mere machines that lack sentience and thought. On at least one occasion, Descartes was defensive about his dissection of animals, but readers sometimes cite his practice of vivisection as evidence that he took the *bête-machine* doctrine seriously.²⁹

In a letter to Mersenne, Descartes reports that soon after arriving in the United Provinces he began working intensively for nine months on a short treatise on metaphysics whose aim was to demonstrate the existence of God and the immortality of the soul – two articles of faith that the Lateran Councils had urged philosophers to defend. Nothing on this topic survives from this period, though it is likely that the ideas he developed found their way into the *Discourse* and the *Meditations*. Descartes claims to have set his metaphysical investigations aside because he first wanted to see how his physics would be received.³⁰ He may have feared that his metaphysics would spark greater controversy.³¹ In any case, his correspondents constantly drew his attention back to science by asking him to explain an ever-increasing number of

²⁶ AT I 102, AT II 621.

²⁷ Borel 1670, 8.

²⁸ AT VI 5–6, CSM I 113.

²⁹ For his defensiveness, see AT II 621. Marjorie Grene notes that many early modern scientists practiced vivisection, even those who did not subscribe to the *bête-machine* doctrine ("The Heart and Blood: Descartes, Plenum, and Harvey," in *Essays on the Philosophy and Science of Descartes*, ed. S. Voss. [Oxford, 1993], 324–36).

³⁰ AT I 144, CSMK 22; cf. AT I 17, 182, 350, CSMK 5, 29.

³¹ Clarke 2006, 101.

phenomena. He was particularly impressed by the reported observation in Rome in 1629 of parhelia, or false suns, which appear as spots of light on either side of the sun, often with a luminous “halo,” and are produced by the refraction of sunlight through ice crystals in the earth’s atmosphere. This phenomenon, which he realized was similar to the rainbow, became the impetus for writing his first major scientific work, *The World*. But what began as a work in meteorology alone kept expanding, so that Descartes could ultimately boast to Mersenne: “Rather than explaining just one phenomenon I have decided to explain all the phenomena of nature, that is to say, the whole of physics.”³² Descartes wrote the work in French over the period 1629–33, but portions of the original treatise are lost. What survives are two main parts – the *Treatise on Light* (now typically called *The World*) and the *Treatise on Man* – which were published separately after his death. One noted scholar of Cartesian science says that these works together “constitute the most ambitious systematic project that Descartes ever undertook.”³³

What makes the work so ambitious is its effort to explain all physical phenomena in purely mechanical terms – that is, as a function of the size, shape, and motion of corpuscles or insensible parts of matter. This marks an implicit rejection of traditional, Scholastic-Aristotelian modes of explanation in terms of qualities, immaterial forms, powers, and faculties, which the new scientists regarded as vacuous and occult. The French playwright Molière (1622–73) immortalized this critique in his play *Le malade imaginaire*, in which a traditionally trained doctor explains how opium induces sleep in terms of a “dormitive power” – the very thing that one wants explained. But unlike some seventeenth-century scientists, Descartes was careful not to reject Scholastic forms and powers explicitly, lest he offend the church; his strategy was simply to ignore them in favor of mechanistic explanations.

The World also envisages a unified science of nature in which all phenomena are explained by means of a few simple laws and an austere conception of matter as bare extension – homogeneous and inert. Descartes realized that his explanatory theories would violate our commonsense understanding of the world and so infuses the work with several clever and intuitive analogies. To convince the reader, for example, that perception does not require resemblance, he compares the relation between the physical cause of a given sensation and the sensation itself to the relation between words and the meanings they signify. In both cases, the relation is arbitrary. Thus, the sensation of tickling is very different from the feather that causes it.³⁴ In the *Treatise on Man*, he claims that our nerves are filled with fluid and that this fluid impels our limbs to move in the same way that water causes the machines in the royal fountains to play instruments or utter words.³⁵ The human body and all animal

³² AT I 70, CSMK 7.

³³ G 7.

³⁴ AT XI 4–5, CSM I 81–82.

³⁵ AT XI 130, CSM I 100.

bodies are conceived on the model of a hydraulic machine in which the pressure of fluids (or “animal spirits”) causes all of their motions.

Descartes was acutely aware that his project would likely stir up controversy, which is one reason he presented it as a fable, even though he wanted the reader to see how closely the actual world resembles this supposedly “hypothetical” model. The *Treatise on Light* was controversial because it endorsed the heliocentric conception of the solar system, first formulated by Copernicus in the sixteenth century. This ran contrary to the Catholic Church, which followed Aristotle and Ptolemy in holding that the earth occupies the center of the universe and is completely immobile, and all of the other heavenly bodies, including the sun, revolve around it. It is sometimes noted, however, that the *Treatise on Man* was even more radical and potentially riskier than its companion.³⁶ In it, Descartes tries to do for human physiology what Copernicus did for the cosmos – namely, revolutionize our conception of it. Whereas Scholastic writers speculated that various vital functions such as digestion, reproduction, and blood circulation were attributable to different souls (viz., the “vegetative” and “sensitive” souls), Descartes argued that they could be explained mechanistically – largely on the hydraulic model. He even explained much of sense perception in this way, thereby stressing the symmetry between human and animal perception (while reserving a higher form of sensory cognition for the human mind).

Descartes had intended to send a copy of *The World* to Mersenne by the end of 1633, but news of Galileo’s condemnation by the Roman Inquisition changed everything. Descartes apparently felt somewhat competitive with Galileo, whom he knew was about to publish a book on cosmology that would rival his own. So he inquired in late 1633 when *The Dialogue on Two World Systems* would appear, only to learn that it had been published earlier that year and that all of the copies were confiscated immediately and burned for advocating the Copernican hypothesis.³⁷ Galileo was also placed under house arrest and compelled to renounce his views. Descartes reports being shocked by Rome’s reaction, especially since Galileo was Italian and “in the good graces of the Pope.”³⁸ In response, he decides to withhold publication of the manuscript on which he had worked tirelessly for the previous four years and which would have solidified his reputation as one of the leading scientists of his day. He could not simply excise the thesis of the earth’s motion, for if that were false, then

so too are the entire foundations of my philosophy.... And it is so closely interwoven in every part of my treatise that I could not remove it without rendering the whole work defective. But for all the world I did not want to publish a discourse

³⁶ See, e.g., Clarke 2006, 121.

³⁷ AT I 270, CSMK 40.

³⁸ AT I 271, CSMK 41.

in which a single word could be found that the church would have disapproved of; so I preferred to suppress it rather than to publish it in a mutilated form.³⁹

Descartes believed that our solar system, with planets revolving around a central star, was one of indefinitely many. So to deny the earth's motion would be to abandon his entire cosmology.

Descartes initially planned to send *The World* to Mersenne even after learning of Galileo's fate, since he had promised it to him for so long, but then decided to suppress it completely "in order to give obedience to the church."⁴⁰ However, this was less a case of blind submission to religious authority than it was a political tactic. While Descartes clearly wanted to convince his Catholic brethren of his views, he realized that doing so would take cunning, strategy, and timing. Here, he cites as his motto, "He lived well who hid well."⁴¹ Some biographers have wondered why Descartes feared persecution from the church since he was relatively untouchable in Protestant Holland, but this misunderstands Descartes' main concern, which was that his ideas be widely accepted by his French compatriots and Catholics generally. He did not want to be seen as an outcast or, worse, a heretic. On the contrary, he aspired to have his philosophy taught in the Jesuit schools.

4. THE *DISCOURSE ON METHOD* AND "ESSAYS"

Chastened by Galileo's condemnation but not deterred, Descartes spent the next few years repackaging many of the ideas contained in *The World*, studiously avoiding the Copernican hypothesis. These efforts resulted in two essays: the *Meteors*, which reports his findings on atmospheric phenomena such as rainbows and parhelia, and the *Dioptrics*, which contains his theories of lenses and visual perception. He also completed his *Geometry*. These three "essays," together with a lengthy "preface," were published in Leiden in 1637 under the title *Discourse on Method of rightly conducting one's reason and seeking the truth in the sciences, and in addition the Dioptrics, the Meteors, and the Geometry, which are essays in this Method*. As the title suggests, Descartes' first published work shows the same concern with method as the *Rules* and in fact even borrows some of the same methodological principles, such as that one should divide complex problems into as many simpler ones as possible (divide and conquer).⁴² Descartes articulates four such rules of method in the *Discourse*, but critics have found them to be rather thin. Leibniz famously quipped: "They are like the precepts of some chemist: take what you need,

³⁹ Ibid.

⁴⁰ AT I 281, CSMK 42.

⁴¹ *Bene vixit, bene qui latuit* (Ovid) (AT I 286, CSMK 43).

⁴² AT VI 19, CSM I 120.

do what you should, and you will get what you want.”⁴³ In response to concerns by Mersenne about the title, Descartes responded:

I have not put *Treatise on the Method* but *Discourse on the Method*, which means *Preface or Notice on the Method*, in order to show that I do not intend to teach the method but only to discuss it. As you can see from what I say, it is concerned more with practice than with theory.⁴⁴

Descartes' aim was not to discuss his method at length but merely to showcase some of its results as advertisements for his new philosophy.

In general, the *Discourse* was a trial balloon designed to see how readers would respond to Descartes' novel, but less controversial, ideas before divulging his complete philosophy. This strategy manifests itself in several ways. First, Descartes published it anonymously so that if readers rejected the work, it would be easy to disavow it, a plan he had hatched from the beginning. Speaking of the *Meteors* in 1629, he tells Mersenne: “I have decided to publish this treatise as a specimen of my philosophy and to hide behind the picture in order to hear what people will say about it.”⁴⁵ Second, he wrote the *Discourse* in the French vernacular, rather than Latin, the language of intellectuals, so that it would be intelligible to everyone, including women (who were generally uneducated).⁴⁶ The goal seems to have been to create a groundswell of favorable opinion among ordinary readers, who would likely be more receptive to his views because they were not mired in the prejudices of traditional philosophy. It also limited the exposure of his ideas to the French (the *Discourse* was not translated into Latin until 1644).

Third, when originally working on his treatise on metaphysics in the late 1620s, Descartes had told Mersenne that he shelved that project because he thought it would be more “advisable” (i.e., less risky) to introduce readers to his physics first.⁴⁷ But after Galileo's condemnation, he adopts a new strategy. He seems to have realized that if he were ever to persuade traditionalists of his new ideas, he would need to uproot their dogmatically held metaphysical views. This realization explains what is sometimes referred to as Descartes' “epistemological turn.” In part 4 of the *Discourse* proper, he introduces readers for the first time to his epistemology and metaphysics.

⁴³ *Die Philosophischen Schriften von Gottfried Wilhelm Leibniz*, 7 vols., ed. C. I. Gerhardt (Hildesheim, 1960), IV 329.

⁴⁴ AT I 349, CSMK 53; cf. AT I 559–60, CSMK 85.

⁴⁵ AT I 23–24, CSMK 6. This is a reference to a story by Pliny the Elder about the painter Apelles of Kos (fourth century B.C.E.), who reportedly placed his works in front of his studio, while hiding in the back to hear the candid reactions of passersby. Cf. the similar expression in the *Discourse* (AT VI 3–4, CSM I 212), a reference I owe to Verbeek.

⁴⁶ AT I 560, CSMK 86.

⁴⁷ AT I 144, CSMK 22.

Here we find, for example, the first statement of his famous *cogito* – “I think, therefore I am” (*Je pense donc je suis*) – as well as arguments for God’s existence. Descartes also introduces some of his skeptical arguments, whose primary aim is to dislodge the prejudices of his readers so that they will be more receptive to his new ideas. In keeping with the nature of this work as a trial balloon, however, even his epistemology and metaphysics are presented in schematized form. Finally, to whet the reader’s appetite for his natural philosophy, part 5 of the *Discourse* summarizes the contents of the *World*.

Descartes thought that his three “specimen essays” constituted the most important parts of his first published book, but ironically it is the *Discourse* proper (the “preface”) that has stood the test of time. Among French scholars, it is often regarded as his magnum opus. Its free and sometimes autobiographical style, largely unburdened by the technical language of the schools, set the standard for modern French philosophical prose.

After the *Discourse* was published, Descartes sent copies to influential politicians, Jesuits, and university professors and urged them to provide objections so that he could make corrections. His readers responded with a broad range of criticisms, covering everything from the circulation of the blood and the physiology of the heart to his theory of machines, and from his arguments for God’s existence to the fact that his *Geometry* was (deliberately) written in a way that made it difficult to read. These objections and Descartes’ replies produced a rich and lively correspondence over the next few years, and the objections on metaphysical questions, such as the immateriality of the soul, helped shape his next work, the *Meditations*. He originally planned to publish the objections and replies as a book, but this goal was ultimately abandoned. Descartes encouraged readers to disagree with him; as he tells Mersenne:

I am very grateful for the objections which you have sent me, and I beg you to continue to tell me all those you hear. Make them as unfavorable to me as you can; that will be the greatest pleasure you can give me. I am not in the habit of crying when people are treating my wounds, and those who are kind enough to instruct and inform me will always find me very docile.⁴⁸

Descartes was in fact gracious with some objectors, but he could also be quite testy. Most notably, the criticisms he received from two famous mathematicians, Pierre Fermat and Gilles Personne de Roberval, led to a heated dispute. Descartes behaved badly, displaying again his defensive and quick-tempered nature as he had in the Beeckman affair. In soliciting objections to the *Discourse*, Descartes aimed to ensure that readers understood him and, apparently, to create a clamoring for his metaphysics and physics,

⁴⁸ AT I 349, CSMK 52–53.

to which he would sometimes allude in his replies but which he continued to suppress. Descartes was still worried about the church's potential reaction, but he was also a savvy self-promoter and may have thought that pent-up demand for his works might improve chances of a favorable reception.

One tends to think of Descartes as a celibate loner and workaholic, an image that he cultivated. This image is largely correct, but he did have a few very close friends, various supporters with whom he regularly corresponded, and at least one notable romantic encounter. In October 1634, at age thirty-eight, Descartes fathered a daughter with a maid named Helena, who was likely much younger than he. The child, named Francine (likely after France), was born in the summer of 1635, presumably out of wedlock, but Descartes is listed as the father on the baptismal record.⁴⁹ Unfortunately, like many children before the discovery of antibiotics, Francine suffered an early death, passing away from scarlet fever in 1640 at age five. Helena and Francine apparently had lived with Descartes for one or more periods, but he hid the nature of the relationships by referring to his daughter as his niece.⁵⁰ Before her death, he was planning to send her to a distant relative in France to be educated. Although his relationship with Helena was short-lived, there is evidence that Descartes provided her with a generous dowry when she married a Dutchman in 1644. Following the word of Descartes' friend and executor, Claude Clerselier, Baillet tries to apologize for this lapse from celibacy, as if Descartes were a monk rather than a philosopher.⁵¹ He even suggests that this episode was merely an experiment in anatomy!⁵² Contrary to Baillet, one presumes Descartes had other sexual relations over the course of his adult life, and perhaps even romantic relationships, but if so he and his supporters hid them well.

Descartes' father and sister died in the same year as his daughter. When he learned months later that his friend Alphonse Pollot had lost a brother, Descartes tried to console him: "I am not one of those who think that tears and sadness are appropriate only for women.... Not long ago I suffered the loss of two people who were very close to me, and I found that those who wanted to shield me from sadness only increased it."⁵³ Because Descartes had in fact lost three relatives recently, biographers have speculated as to which two he had in mind here, with most agreeing that it was his daughter and sister, as he was never close to his father.⁵⁴ Although he

⁴⁹ Watson 2002, 171. Watson notes that since Helena was a Calvinist, Descartes would have had to convert to marry her.

⁵⁰ AT I 393.

⁵¹ Baillet 1691, II 502.

⁵² Baillet 1691, II 91.

⁵³ Mid-January 1641; AT III 278, CSMK 167.

⁵⁴ In a letter to Mersenne, though, he expresses "great sadness" about his father's death: "I very much regret not having been able to go to France this summer, to see him before he died" (December 3, 1640; AT III 251, CSMK 160).

expresses sorrow in this passage, he tended to be rather stoic about death, a position that had its source in his belief in the immortality of the soul and in his view that reason should regulate the passions. In the rest of this letter, in fact, he urges Pollot to moderate his despair, for "it would be dishonorable to abandon oneself completely to grief; we do ourselves no credit if we do not strive with all our might to free ourselves from such a troublesome passion."⁵⁵ Consistent with these remarks, Descartes returned to work within eight days of Francine's death.

5. *MEDITATIONS ON FIRST PHILOSOPHY*

To answer some of the objections he received to the *Discourse*, Descartes realized that he had to expand what he said in part 4 about the soul and God into a full-length book. What came to be known as the *Meditations*, however, was not just more detailed; it was also written in a different style and, since it was penned in Latin rather than French, addressed to the learned. The goal of this new project, however, was the same as the *Discourse*: to soften readers up for his physics. The six *Meditations* focus exclusively on questions in metaphysics and epistemology, but Descartes tells Mersenne that they contain the "foundations" of his physics. "But please do not tell people, for that might make it harder for supporters of Aristotle to approve them. I hope that readers will gradually get used to my principles, and recognize their truth, before they notice that they destroy the principles of Aristotle."⁵⁶ One facet of human psychology that Descartes understood quite well was the habitual nature of belief. Beliefs long held or formed in childhood are the most difficult to relinquish. If Descartes attacked his opponents' beliefs directly, he knew he would be met with great resistance. Instead he asks his readers to set aside their beliefs provisionally as part of a theoretical exercise and presents three skeptical arguments to aid in this endeavor. He does not inform readers that his goal is to replace their long cherished metaphysical commitments with his own.

In an attempt to provide a foundation for his scientific project, Descartes is assuming a complex account of the relation between metaphysics and physics, but the main idea is simple. The Scholastic Aristotelians were committed to hylomorphism, the view that physical objects consist of matter and form, where the latter is something immaterial or "soul-like." Descartes rejected this view and revolutionized the conception of physical objects (or "bodies") by reducing them to spatial extension alone (length, breadth, and depth). This new conception entails that the only properties of bodies are mechanical – namely, size, shape, and motion – which means that only these properties can figure into scientific explanations. Scholastic modes of explanation in terms of forms and various occult qualities are rendered idle. As

⁵⁵ AT III 279, CSMK 167.

⁵⁶ AT III 298, CSMK 173.

Descartes sees it, hylomorphism conflates the idea of body with the idea of soul (or mind). Thus, one of the main goals of the *Meditations* is to carefully distinguish these ideas so that one can appreciate that souls and bodies are “really distinct” substances, meaning that they can exist independently of each other. Establishing the latter also proves that the soul is naturally immortal – a selling point for Cartesian philosophy among theologians.

Published in 1641, the *Meditations on First Philosophy* has become Descartes' most celebrated work and with good reason. It is among the most masterfully written books in the history of philosophy. Although Descartes sometimes refers to the *Meditations* in his correspondence as his “treatise” on metaphysics, it is not a treatise in the traditional sense. As the term “Meditations” suggests, the work is modeled after religious writings and practices, specifically those devised by Saint Ignatius Loyola (founder of the Jesuit order) in *Spiritual Exercises* (1522–24), which consists of meditations, prayers, and cognitive exercises. Descartes would have been exposed to such exercises at La Flèche and probably participated in the abbreviated eight-day version of them that took place annually. Like Ignatius's *Exercises*, Descartes' *Meditations* is carefully crafted to produce a permanent change in the meditator's intellectual habits and will.⁵⁷ In the case of the *Meditations*, this involves teaching the meditator to withdraw from the senses, turn away from traditional authorities, and affirm only those clear and distinct ideas that she finds within her mind. The *Meditations* is written as a guidebook to the truth, but its success depends on readers' willingness to implement faithfully the exercises that Descartes prescribes. There is much beneath the surface of this work, including a view about how knowledge is attained and a complex psychological strategy for helping the meditator attain it. Descartes takes the average reader to be an empiricist of sorts but is himself a nativist who holds that knowledge is obtained by clearly and distinctly perceiving the purely intellectual ideas implanted within the mind. One of the primary goals of meditation is to acquire facility in grasping these ideas.

It might seem that by co-opting Ignatius's *Exercises* that Descartes would have no trouble ingratiating himself with the Jesuits. But, in fact, he was extremely worried about how they would respond to the *Meditations*. The Jesuit priest Pierre Bourdin had earlier attacked the *Dioptrics*, and this put Descartes on the defensive, in part because the attack occurred behind his back; he did not like a debate that he could not control. He wrote to Huygens in July 1640 saying that he was steeling himself for “a war with the Jesuits.”⁵⁸ His reaction seems excessive, especially since other readers had criticized that work too, but is somewhat more reasonable given Descartes' belief (however mistaken) that the Jesuits were always of one voice. To

⁵⁷ Zeno Vendler, “Descartes' Exercises,” *Canadian Journal of Philosophy* 19 (1989): 193–224; see esp. 194–95.

⁵⁸ AT III 752, CSMK 151.

outflank the Jesuits, he decided to postpone publication of the *Meditations* and to circulate copies among a few friendly theologians such as Gibieuf to win their support first. He also decided to dedicate it to the fathers at the Sorbonne “asking them to be my protectors in God’s cause. For I must confess that the quibbles of Father Bourdin have made me determine to fortify myself henceforth with the authority of others.”⁵⁹ He enlisted Mersenne to be his point man in these stratagems, telling him that, “no matter what the justice of one’s cause, one still needs friends to defend it.”⁶⁰ As far as we know, the fathers at the Sorbonne made no official statement on the matter, but his letter of dedication prefaces the work.

Although Mersenne did solicit objections, he did not confine himself to theologians. Soon, there was a total of six sets of official “Objections.” Together with Descartes’ “Replies,” they were appended to the first edition of the *Meditations* that appeared in Paris in August 1641. It is sometimes wondered why Descartes bothered to solicit objections since he did not take criticism well, as is clear in his Replies to Thomas Hobbes and Pierre Gassendi, who penned the Third and Fifth Sets of Objections, respectively. But this assessment is somewhat unfair. Descartes was gracious and responsive to most of his objectors, including Mersenne (who had a major hand in the Second and Sixth Sets of Objections), Johannes Caterus (a Catholic theologian, living in Holland, whose First Set of Objections Descartes’ had solicited via his Dutch contacts), and especially Antoine Arnauld (a theology student at the Sorbonne) whose Fourth Set of Objections Descartes deemed to be the best because they demonstrated a deep understanding of his work and a willingness to meditate with him faithfully.⁶¹ Descartes was indeed rude and dismissive in response to Hobbes and Gassendi, but they were hostile readers; Gassendi even addressed Descartes sarcastically as “O Mind” (as if he were a disembodied soul). They also were not theologians but philosophers in their own right with rival metaphysical systems. Their objections did not fit neatly into Descartes’ original plan to win support from theologians, though that plan had failed because no French theologian other than Mersenne, including Gibieuf, wanted to commit himself for fear of offending the Sorbonne fathers, who held ultimate authority on religious matters in France.⁶² It is a shame from our perspective that Descartes did not take Gassendi’s and Hobbes’s objections more seriously, as some of them were quite important. Nevertheless, it is rare in the history of philosophy to have a document like the *Objections and Replies*, which records how a leading thinker’s ideas were received by some of the leading intellectuals of his day and how he responded to their criticisms and queries. It is an invaluable tool for interpreting the *Meditations* proper and for understanding the

⁵⁹ AT III 184, CSMK 1153.

⁶⁰ AT III 240, CSMK 159.

⁶¹ AT III 331, CSMK 175.

⁶² I owe this point to Verbeek in correspondence.

intellectual milieu in which he wrote, so long as one keeps in mind that Descartes often tailored his Replies to his reader's presuppositions, a fact that sometimes gives the appearance of inconsistency.

As a result of his ongoing dispute with Bourdin, a Seventh Set of Objections and Replies was produced (though Bourdin's objections were unsolicited) and appeared in the second edition of the *Meditations* published 1642 in Amsterdam. This is standardly regarded as the authoritative Latin edition as the first was laced with errors introduced by the publisher, Michel Soly of Paris. Descartes also appended a Letter to Father Dinet, the provincial of the Jesuits in France, in which he complains about the feebleness of Bourdin's criticisms, including the common objection that Cartesian philosophy encourages skepticism. The Letter was motivated by Descartes' mistaken view that Bourdin spoke for the entire Jesuit order. By the end of 1642, Bourdin and Descartes agreed to a truce.

6. THE THEOLOGICAL CONTROVERSIES AT UTRECHT AND LEIDEN

Although Descartes lacked a traditional career such as teaching that would have provided an easy means for winning converts, he cultivated influential friends and supporters who helped champion his ideas. But some of his supporters were more zealous and difficult to control than others, and in a couple of notable cases this zealotry resulted in religious scandal, something he had tried hard to avoid. In 1638 Descartes was introduced through his close friend Henricus Reneri (1593–1639) to Henricus Regius, a professor of medicine and colleague of Reneri's at the University of Utrecht. Descartes and Regius were soon friends and, unlike Reneri, who supported Descartes' career but was not a follower, Regius became a disciple. When they met, Regius was already familiar with Descartes' *Discourse* and was inspired to develop a physics of his own based on Cartesian principles. He wanted to publish a book on the subject, but Descartes – perhaps because he feared that his own work would be preempted or misrepresented – convinced him to deliver a series of public disputations instead.⁶³ In the last of these, held on December 8, 1641, Regius scandalized his colleagues by denying the existence of substantial forms, affirming the Copernican hypothesis, and defending the anti-Scholastic thesis that the union of the human body and soul is merely accidental rather than essential (in the language of the Schools, an *ens per accidens* rather than an *ens per se*). All three claims, but especially the third, incensed Gysbertus Voetius, the rector of the university, as well as the other theologians in attendance. From their perspective, to deny the essential connection between body and soul was in effect to deny the

⁶³ Verbeek 1992, 13. I lean heavily on Verbeek's admirable discussion of the Utrecht and Leiden controversies in what follows.

doctrine of Resurrection. Descartes realized, in a way that Regius did not, that nothing he said could have been more inflammatory.⁶⁴ Regius's final disputation ended in bedlam, not least because it had been dedicated to the professors of theology. Voetius soon responded with a disputation defending Aristotelianism and attacking the new philosophy, while also mentioning Descartes' name multiple times in unfavorable terms.⁶⁵

Both Descartes and Regius agreed that Voetius's attack should not go unanswered lest they give the appearance of defeat. In a twenty-page letter, Descartes practically writes Regius's response for him. Much of his advice shows great diplomacy, but he cannot help but include one gratuitous jab by claiming that Aristotelians are committed to the materiality of the soul, which is tantamount to a charge of atheism.⁶⁶ Regius added further insult by asserting that his theological colleagues were motivated by envy. Regius's *Responsio*, which appeared on February 16, 1642, was immediately confiscated; the "new philosophy" was condemned; and Regius was forbidden to teach anything but medicine.⁶⁷

The controversy continued to escalate after Descartes devoted the second half of his Letter to Father Dinet to a barrage of personal invective against Voetius. What had been a local matter now was available for the world to judge. Voetius was furious and engaged his ally Martinus Schoock, who, in a lengthy book, accused Descartes of being a skeptic and an atheist on the grounds that he rejects traditional arguments for God's existence in favor of novel, weak ones. He compared him to the heretic Vanini, burned at the stake in 1619, and also implied that he was guilty of moral turpitude. Enraged, Descartes wrote a nearly two-hundred-page open letter to Voetius – whom he claimed was the real author of Schoock's book – in which he railed about the viciousness and wickedness of the attack and called upon university and town officials to punish him. This action prompted Voetius to sue Descartes for libel. Descartes sought protection from the French ambassador, who was able to convince the Prince of Orange to intervene on his behalf, but much to Descartes' chagrin a verdict in the case was never rendered, which meant that suspicions lingered and he was never fully vindicated.

How should we judge Descartes' behavior in this affair and what were his motivations? His powerful friend Constantijn Huygens, secretary to the Prince of Orange, had urged him to stay out of the dispute between Regius and his colleagues: "Theologians are like pigs. When you pull one by the tail they all squeal."⁶⁸ Contemporary biographers tend to agree that Descartes acted in ways that inflamed the crisis and were self-defeating. His actions reflected his vanity

⁶⁴ AT III 460, CSMK 200.

⁶⁵ Verbeek 1992, 16–17.

⁶⁶ AT III 491–510, esp. AT III 494 and 505; CSMK 205–9 (excerpts).

⁶⁷ Verbeek 1992, 19.

⁶⁸ AT III 677–78.

and quick-temperedness, but some of his remarks to Father Dinet suggest a more rational explanation. Apart from rebutting the serious charge of atheism, Descartes appears also to have been concerned about the fate of his “new philosophy.” Utrecht was the first university where his ideas had been taught; it might have also been the last. Even if he had not written public letters to Dinet and Voetius, rumors that his philosophy had been poorly received would likely have spread to Catholic countries.⁶⁹ And in his Letter to Dinet he worries that such criticisms might increase the suspicion that people already have toward novel opinions. Although he was not always consistent about this, Descartes tended to downplay the innovative character of his philosophy, but the theologians at Utrecht made this a central point of their attack. Descartes calls upon Dinet for a fair hearing: “I know how easy it is ... to be condemned by many sensible people, once a few envious critics have attacked [one’s philosophical system] by making allegations about its ‘novelty.’”⁷⁰ Descartes was also clearly appealing to the sympathies of a fellow French Catholic against an orthodox Dutch Calvinist.

Part of the Utrecht controversy was replayed at Leiden University in 1647, after a professor of logic there, Adriaan Heereboord, gave a series of disputations praising Cartesian method and criticizing Aristotelianism. These lectures provoked the ire of two of his theological colleagues, Jacobus Revius and Jacobus Trigland, who, following the lead of their counterparts at Utrecht, claimed that the method of doubt encourages skepticism and accused Descartes of blasphemy for doubting the existence of God and for rejecting traditional arguments for God’s existence. They also drew theological consequences from Descartes’ emphasis on human freedom by charging him with Pelagianism, which holds that man is able to earn salvation through his free acts, something that orthodox Calvinism – with its emphasis on predestination – vehemently denies. Descartes, who had been a matriculated student at Leiden and had friends there, such as the professor of mathematics Jacob Golius, was aghast. He wrote a long letter to the curators at the university demanding an apology and retraction and insinuating that he would cause a scandal if they failed to comply. But the curators reacted instead by prohibiting discussion of Cartesian philosophy, either for or against. Unsatisfied, Descartes once again pled his case to the French ambassador and the Prince of Orange, who intervened on his behalf.⁷¹

⁶⁹ I disagree with Watson’s claim that the Utrecht affair would have remained a local matter if it were not for Descartes’ interventions (Watson 2002, 228–30).

⁷⁰ AT VII 603, CSM II 397. Incidentally, this explains why Descartes’ recriminations against Voetius appear in the letter, whose primary purpose was to complain about Pierre Bourdin’s objections.

⁷¹ See Verbeek 1992, 34–51.

7. CORRESPONDENCE WITH PRINCESS ELISABETH

Fortunately for Descartes, there was at least one bright spot in his life during these theological controversies. In October 1642 he received a letter from his friend Pollot, gentleman in waiting to the Prince of Orange, informing him that Princess Elisabeth of Bohemia (1618–80) had read the *Meditations* and wanted to meet with him to discuss his philosophy. Impressed by royalty and excited about the prospect of enhancing the reputation of his work, Descartes eagerly complied. Their meeting initiated one of the richest and most important correspondences of his life, comprising fifty-nine known letters from 1643 to 1649. It ranged over a variety of topics, including the causal interaction between mind and body, happiness, the highest good, medicine, the passions, and the consistency of divine providence with human freedom. The quality of the correspondence was due in large measure to the intellectual acuity of Elisabeth, who raised several incisive objections that forced Descartes to elaborate his doctrines and even to rethink some of them. Unlike most women of the period, Elisabeth was educated and fluent in several languages. But her family suffered several misfortunes. Most notably, her father Frederick V lost his throne after a short reign when he was defeated at the Battle of White Mountain in 1620, and the family was forced to seek asylum in The Hague, where Elisabeth was living when Descartes first came to meet her.

Elisabeth's most famous objection to the *Meditations* concerns the relation between the human mind and body. In the Sixth Meditation, Descartes asserted that mind and body causally interact. Elisabeth wondered how this is possible, specifically, how one's mind – which he claimed is a purely thinking, immaterial being – can produce an effect in one's body, since, unlike two material objects, they cannot affect each other through physical contact.⁷² This is the first known statement of the famous “mind-body problem.” The problem concerns the intelligibility of mind-body interaction, and the worry is that if it is inconceivable, then it is impossible. Descartes responded by appealing to three (and sometimes four) “primitive notions.” He claimed that we have distinct primitive notions of mind, body, and the mind-body union (or interaction) – each with its own domain of application – and that Elisabeth is mistakenly using the notion of body to conceive of mind-body interaction, as if the latter should be understood on the model of body-body causation. To motivate the soul's ability to move the body, he also appealed to an analogy with gravity.⁷³ Like many readers, Elisabeth found his reply to be opaque, but Descartes attempted to elucidate it further in a second letter, where he added that the mind-body union cannot be conceived intellectually but only sensed or felt.⁷⁴

⁷² AT III 661.

⁷³ AT III 665–67, CSMK 218–19.

⁷⁴ AT III 692, CSMK 227.

"Everyone feels that he is a single person with both body and thought so related by nature that thought can move the body and feel the things which happen to it."⁷⁵ Commentators continue to debate the cogency of Descartes' replies. Apropos the last citation, they wonder how conceiving of one's mind and body as a single thing helps us to understand their interaction and does not instead make it inconceivable.

In the ensuing correspondence, Elisabeth shares some of the details of her personal life, such as the depression she feels (e.g., over her family's misfortunes) and, later, her severe illness. In reply, Descartes makes various efforts to console and treat her in the role of physician. These discussions lead him to articulate views in psychology, physiology, medicine, and ethics. In one notable letter, he boldly (and implausibly) claims that he cured himself of his childhood lung ailment by redirecting his imagination and choosing always to look at things from the most favorable angle – the power of positive thinking.⁷⁶ "For no events are so disastrous, or so absolutely bad in the judgment of ordinary people, that they cannot be considered in some favorable light by a person of intelligence."⁷⁷ Descartes also claimed that one should resolve to submit one's passions to reason and guide all of one's actions by it alone, but Elisabeth wondered how that is possible since some passions and illnesses impede the use of reason.⁷⁸ Descartes is forced to concede that the passions can be controlled only indirectly and works out the details of this point in the last book published in his lifetime, *Passions of the Soul*, (1649), which Elisabeth inspired.

Descartes clearly thought very highly of Elisabeth's intellectual and philosophical talents. It served his own interests to dedicate the *Principles of Philosophy* (1644) to her, but in his dedicatory letter he compliments the "outstanding and incomparable sharpness" of her intelligence and asserts that she is "the only person I have so far found who has completely understood all my previously published works."⁷⁹ Descartes appears to have had considerable personal affection for Elisabeth, who never married. Some biographers claim that she was the great love of his life, and there are speculations about whether they had a romantic relationship. Could the man who was her friend, mentor, and physician also have been her lover? This seems unlikely given that they apparently met face-to-face very few times.

8. THE *PRINCIPLES OF PHILOSOPHY*

In late 1640, while writing replies to objections to the *Meditations*, Descartes began drafting a more ambitious work that was intended to summarize his entire philosophy. At the

⁷⁵ AT III 694, CSMK 228.

⁷⁶ AT IV 220–21, CSMK 250–51.

⁷⁷ AT IV 253, CSMK 253.

⁷⁸ AT IV 265–66, CSMK 257–58; AT IV 269.

⁷⁹ AT VIIIA 3–4, CSM I 192.

time, he was obsessed with Bourdin's criticisms of the *Dioptrics* and concerned about winning over the Jesuits, even while bracing for war with them. His plan for this new work, which was to become the *Principles of Philosophy*, was to present his philosophical system in the form of a textbook that could be used by Jesuit teachers in schools like La Flèche. While bold, the plan lacked much chance of success and, in fact, was never realized. Jesuit textbooks tended to be written by – well – Jesuits, or at least university professors or members of the clergy. In preparing for this project, Descartes read (or reread from his school days) several Scholastic textbooks, including Eustachius a Sancto Paulo's *Summa philosophiae quadripartita* (1609), which he deemed “the best book of its kind,” probably because of its brevity and comprehensiveness. Descartes' original plan was to publish Eustachius's compendium in the same volume as his own, with a running commentary on the former, presumably highlighting the deficiencies of Scholasticism in contrast to Cartesianism.⁸⁰ Descartes told Mersenne privately that “it will be very easy to see how one compares with the other; and those who have not yet learned Scholastic philosophy will find it much easier to learn from this book than from their teachers, since they will learn to scorn it at the same time.”⁸¹ In the end, Descartes decided to publish the textbook of his own philosophy – including both his metaphysics and physics – by itself. It is not clear why he changed his mind; Eustachius's death may have been one factor, as he was unable to secure his approval. In any case, the decision was for the best as Descartes' positive views were already controversial. As the Utrecht controversy shows, a polemic against Aristotelianism would have likely alienated his target audience. By nature Descartes was confrontational, but in this case his better judgment seems to have prevailed.

Much of the content of the *Principles*, published in 1644, is borrowed from his earlier works, but the style of presentation is unique. The book is divided into four parts, each of which consists of short articles. Part I recapitulates the material from the *Meditations* – often in a more abbreviated form – including the method of doubt, the *cogito*, and arguments for God's existence. But there is a more expansive account of the causes of human error. Perhaps because it was intended to replace Scholastic textbooks, there is a more detailed discussion of certain Scholastic doctrines such as the theory of distinctions that is crucial to his proof of real distinction between mind and body and to his concepts of attribute and mode. Like the Scholastics, Descartes is also more willing to provide definitions of key concepts, such as that of substance and clear and distinct perception. One of the most important differences is the order of presentation: among other things, Descartes reverses the order of the arguments for God's existence. Prior to publication, Descartes told Mersenne that part I “contains almost the same things as the *Meditations* ... except that it is [written] in an entirely different style” and “in an order which will make it easy to teach.”⁸²

⁸⁰ AT III 232–33, CSMK 156–57.

⁸¹ AT III 259–60, CSMK 161.

⁸² AT III 276, CSMK 167.

The last three parts of the *Principles* are devoted to Cartesian science and borrow and develop material from the *Meteors*, *Dioptrics*, and *The World*. Huygens and other friends had been pleading with Descartes to release the latter for more than a decade. Descartes promises to do so in the *Principles* but only after teaching *The World* “to speak Latin first.”⁸³ The range of phenomena that Descartes attempts to explain is breathtaking and includes the formation of planets and stars, the rotation of the earth, magnetism, sunspots, the nature of light, the regular movements of oceans, the source of tides, the formation of chemicals such as sulfur, the origin of springs, and the effects of gunpowder. In part II, Descartes defends the main principles of his physics, including his three laws of nature. He also deduces several consequences from his conception of matter as pure extension, including that the universe is indefinitely extended, atoms are impossible, and a vacuum is impossible. Part III is devoted to astronomy, and part IV to earth science. Part III finesses the thesis of the earth’s motion that provoked Galileo’s condemnation, which in turn led Descartes to withhold publication of *The World*. His strategy is to define the motion of an object in relation to the bodies in its vicinity. This definition enables him to say that because the particles immediately surrounding the earth remain the same, strictly speaking it is motionless, even while maintaining that the earth and other planets are in fixed orbits around the sun.⁸⁴ While clever, this attempt to palliate the theologians creates problems for Cartesian physics, as critics and scholars have noted.

In the preface added to the French edition of the *Principles* (1647), Descartes famously compares philosophy to a tree, with the roots consisting in metaphysics, the trunk in physics, and the branches in all the other sciences, the chief ones being medicine, mechanics, and morality.⁸⁵ Thus, on his view, metaphysics is in the service of science, which in turn aims to promote human health and happiness.

9. COMMENTS ON A CERTAIN BROADSHEET AND THE RIFT WITH REGIUS

Although Descartes had been successful in 1641 in convincing Regius to confine himself to disputations, the Utrecht professor eventually published his book, *Foundations of Physics* (1646). With the publication of the *Principles* two years prior, Descartes no longer had to worry about his physics being preempted but now had other concerns. First, he believed that Regius plagiarized and distorted some of his unpublished physiological writings (viz., *The Treatise on Man*). Second, Descartes was dismayed that Regius

⁸³ AT III 523, CSMK 210.

⁸⁴ AT VIIIA 90–92, MM 94–96.

⁸⁵ AT VIIIA 14, CSM I 186.

did not think physics required metaphysical foundations and provided little supporting argument for his theories. In fact, Regius rejected Cartesian metaphysics wholesale and even suggested in a letter⁸⁶ that Descartes did not really believe all of the doctrines that he had articulated in the *Meditations* – a charge that infuriated him.⁸⁷ Third, Regius reversed his position on the relation between the soul and the body, but his new position was more untenable theologically than the first. Formerly, he had said that the soul-body union is accidental; now he suggested that for all we know the soul could be a mode of body, which implies that it perishes with the body – a conclusion he tried to avoid by asserting that only scripture can assure one of the soul's immortality. Given their previous association, Descartes worried that readers would think Regius spoke for him. So in the preface to the French edition of the *Principles* (1647), he disavowed Regius's book entirely and publicly accused him of plagiarism, an accusation that was likely unjustified.⁸⁸

Rather than responding with recriminations, Regius planned to clarify his position in corollaries to a medical disputation that was to be delivered October 2, 1647, but the Utrecht rector suppressed them. So Regius and his respondent published them instead in a short broadsheet or pamphlet, *Explication of the Human Mind*, which, without mentioning Descartes by name, rejected one of the pillars of Cartesian epistemology – that there are innate ideas. It also asserted that while we have an idea of God, like all ideas this one does nothing to guarantee the existence of its object, contrary to both of Descartes' theistic arguments.⁸⁹ On the nature of the mind (or soul), Regius expressed the sort of agnosticism that one associates with John Locke: for all we know, the mind is a substance in its own right, a mode of a corporeal substance; or thought and extension are attributes coexisting in the same subject.⁹⁰ Although the broadsheet was published anonymously, Descartes felt compelled to repudiate it. *Comments on a Certain Broadsheet* was published in January 1648, though apparently without Descartes' knowledge, and edited by Adriaan Heereboord, his ally at Leiden.⁹¹ In it, Descartes critically analyzes some of the twenty-one theses in Regius's broadsheet, which was reprinted at the beginning of the *Comments*, and clarifies some of his own philosophical positions. Readers have been surprised by Descartes' claim that *all* of our ideas are innate, not just our intellectual ideas (as implied in the *Meditations*), and his suggestion that innate ideas are in some sense dispositional.⁹² The *Comments* also contains interesting remarks about the difference between simple and composite entities, giving commentators fodder

⁸⁶ AT IV 254–56.

⁸⁷ AT IV 256–58.

⁸⁸ AT IXB 19, CSM I 189. As Verbeek (1992, 54) argues.

⁸⁹ AT VIIIB 345, CSM I 295–96.

⁹⁰ AT VIIIB 342–43, CSM I 294–95.

⁹¹ Verbeek 1992, 58.

⁹² AT VIIIB 358–59, CSM I 303–4.

for debate about the status of the human being or mind-body union.⁹³ Descartes also used this work as an opportunity to respond to recent attacks by Voetius and some of the theologians at Leiden by distinguishing three types of truth: those accepted on faith alone (e.g., the Trinity and other mysteries), those believed on faith but amenable to rational demonstration (e.g., the existence of God and the mind-body distinction), and those pertaining to reason alone (e.g., mathematical truths). Regius responded to the *Comments* with another broadsheet. At this point, Descartes left well enough alone. Although the two philosophers appear not to have corresponded again after 1645, there is some evidence that on his deathbed Descartes forgave his former pupil.⁹⁴

10. CONVERSATION WITH BURMAN

One of the most extraordinary texts associated with Descartes is the *Conversation with Burman*. As the title suggests, the work is based on a conversation that the philosopher had with Frans Burman (1628–79), a twenty-year-old Dutch theology student at the University of Leiden. Burman met Descartes at his remote country home in Egmond in Northern Holland, where the two men appear to have shared a meal and had a lengthy, in-depth discussion in Latin on April 16, 1648. Burman came with prepared questions about more than seventy specific passages within Descartes' major published works. Many of the most important topics in Cartesian philosophy are addressed, including skepticism, the *cogito*, the Cartesian Circle, the thesis that the mind always thinks, the nature of memory, material falsity, the relation between a substance and its attributes, free will, mind-body interaction, the relation of metaphysics to physics, and innate ideas, as well as various issues in physics. Burman asks perceptive questions that demonstrate a deep understanding of the texts and of the Cartesian system as a whole, though we do not know whether the questions were formulated by Burman alone or whether he had help from some of the professors at Leiden. In any case, Descartes was unusually forthright and expansive in his answers, and Burman often follows up, making for a lively discussion and providing the Frenchman with a unique opportunity to clarify his views in what would turn out to be the final years of his life.

There are questions, however, about the reliability of the text, which was not written by Descartes. We do not know whether Burman took detailed notes during the discussion, but four days later he conveyed what he had to Johannes Clauberg, who produced a complete version of the text, which was then copied by an anonymous scribe. Some readers have questioned whether Burman was a reliable reporter and whether the content of the conversation was compromised by either Clauberg

⁹³ AT VIII B 349–51, CSM 298–99.

⁹⁴ Verbeek 1992, 61.

or the copyist and, if so, to what degree. But after reviewing the style and content of the text, which can be compared with Descartes' vast writings, the English translator of the *Conversation* concludes that "there are grounds for supposing that Burman's reporting was, on the whole, very faithful."⁹⁵ If this is correct, what we have is a fairly unique document in the history of philosophy. In the *Discourse*, Descartes wrote that "reading good books is like having a conversation with the most distinguished men of past ages – indeed, a rehearsed conversation in which these authors reveal to us only the best of their thoughts."⁹⁶ This remark applies to the *Conversation*, with Burman often asking the very questions that Descartes' readers want answered.

II. SWEDEN: "A LAND OF BEARS, ROCKS, AND ICE" — AND DEATH

In 1649 Descartes traveled to Stockholm to teach philosophy to Christina, the precocious and unconventional twenty-two-year-old queen of Sweden known as the "Minerva of the North." His decision to go would prove to be fatal. He survived the month-long trip by sea but not the harsh winter. The irony is that he had been very reluctant to visit Sweden even as an excursion and regretted his decision soon after arriving.

The decision to travel to Stockholm originated in a series of letters that he exchanged with Queen Christina via Pierre Chanut (1600–62), a French diplomat who would become ambassador to Sweden. Descartes likely met Chanut on his first return trip to Paris in 1644 (after a fifteen-year absence). They were fast friends. Chanut was part of Mersenne's circle and, like Descartes, was engaged in barometric experiments. He is responsible for having inspired Christina's interest in Cartesian philosophy and in convincing her to invite Descartes to Sweden. Chanut, the brother-in-law of Clerselier, thought of himself as helping his friend and also serving his country by strengthening relations between France and Sweden, who were allies in the Thirty Years' War.

The correspondence began in December 1646 when Chanut sent three questions to Descartes from Christina about the nature of love. This was followed by further questions about how to reconcile the infinity of the world with Christian faith and whether man is the ultimate end of creation such that all other things are created for us. In fall 1647, Chanut sent another letter asking about Descartes' views on the supreme good. Descartes responded (November 1647) in a letter addressed directly to Christina, asserting that "the good use of free will is what produces the greatest and most solid contentment in life."⁹⁷ Because he thought his short letter

⁹⁵ B xvii.

⁹⁶ AT V 5, CSM I 113.

⁹⁷ AT V 84, CSMK 325.

might not suffice, he also sent an incomplete draft of *The Passions of the Soul* and six of the letters he had written to Elisabeth (without her permission) on the same topic. Christina thanked Descartes over a year later (December 1648) in a letter written in her own hand, which must have flattered him as he responded with a gushing and obsequious message: "If a letter was sent to me from heaven and I saw it descending from the clouds, I would not be more surprised than I was to receive the letter which Your Highness so graciously wrote me."⁹⁸ Thus followed two letters of invitation via Chanut (February and March 1649) to come to Sweden.

Biographers have debated why Descartes accepted the invitation, for he had grown tired of travel and resigned himself to spending the rest of his life in Holland. He had returned from Paris the previous summer completely disappointed after discovering that promises of a royal pension, which would have enabled him to return to France permanently, were empty. He also found his friends there to be unwelcoming: "They wanted to have me in France as they would wish to have an elephant or a panther – that is, as a rare specimen and not as something that could be useful."⁹⁹ In February 1649, a month before accepting Christina's offer, he told his friend Picot that he was living in Egmond "as peacefully and with as much contentment as he had ever enjoyed" and dreaded "ever undertaking another journey." Similarly, he told Chanut the same month that he would "never ... undertake another journey which relies on promises."¹⁰⁰

The most likely explanation for Descartes' acceptance is that he was flattered by the invitation to teach philosophy to one of the most powerful monarchs in Europe. This was vindication for having been denied a pension in his home country and for what he perceived as a lack of proper recognition for his work in both France and Holland.¹⁰¹ He probably also aimed to escape the theological controversies that he continued to face in Holland. In the letter to Picot cited earlier, he confessed that this country "no longer possessed the attraction that it previously had to retain him."¹⁰² Still, to his friend Brasset he expressed reluctance to leave the land of milk and honey "in order to live in a land of bears, rocks and ice." But, as if to persuade himself, he added: "I am convinced that the beauty of a place is not necessary for wisdom, and that human beings are not like trees, which are never seen to grow so well when they are transplanted in soil less rich than the soil in which they had been sown."¹⁰³ Descartes was clearly ambivalent. His friendship with Chanut, and their shared interest in science, may have tipped the scales.

⁹⁸ AT V 294, CSMK 369.

⁹⁹ AT V 329, CSMK 371. Descartes' trip coincided with political upheaval in France – the beginning of "The Fronde," a series of civil wars (1648–53).

¹⁰⁰ AT V 280, 292–93.

¹⁰¹ Watson 2002, 283–84; cf. Gaukroger 1995, 413–14.

¹⁰² AT V 280.

¹⁰³ AT V 349–50, CSMK 375.

When Descartes finally arrived in Sweden on October 4, 1649, after supposedly impressing and edifying the ship's captain with his knowledge of navigation, he was installed at Chanut's home. Chanut was in Paris at the time but made arrangements for his friend to reside with his wife and children. To help Descartes adjust to his new surroundings, the queen postponed their studies and released him from all duties at court. Eventually, he began instructing her in his philosophy; however, they met at five o'clock in the morning, as this was the only period in her busy schedule when she was free to engage in such pursuits. Although there were relatively few such meetings, one can imagine the effect this had on the philosopher known for being a late riser. To make matters worse, within days of arriving he realized that Christina was fickle. She had lately become interested in learning Greek and studying ancient books, and Descartes worried whether philosophy would even please her. He vowed to do his best to inspire her, but planned to return to Holland no later than the following summer.¹⁰⁴ He also learned that he was not the only foreign scholar that she had invited to Sweden, which meant he had rivals at court for the queen's attention. She intended to create an academy like the ancient one at Athens and asked Descartes to develop plans for it. Perhaps the image of himself as "a rare specimen such as an elephant or panther" came back to haunt him.

As winter set in – supposedly the worst in sixty years – Descartes grew more discontent. It helped that Chanut arrived in December, and he made friends with Frenshemius, Christina's librarian, who also participated in the morning study sessions, and with Brégy, another French diplomat; but social interactions were not what he yearned for most. After Brégy left Sweden when his father died, Descartes wrote to him on January 15, 1650, saying "during the winter the men's thoughts are frozen here, like the water." He added that "my desire to return to my solitude grows stronger with each passing day.... I am not in my element here."¹⁰⁵

Around the time of Descartes' letter to Brégy, Chanut fell ill with the flu. Still residing in the same home, Descartes helped nurse his sick friend but then fell ill himself on February 1 as Chanut was recovering. The illness soon developed into pneumonia. On the ninth day he seemed to improve, but then took a turn for the worst and died at four o'clock on the morning of February 11, just seven weeks shy of his fifty-fourth birthday.

Before he left for Sweden, Descartes had given a trunk of his papers to his good friend in Leiden, Cornelis Van Hogelande (1590–1662), for safekeeping. Initially, he told Van Hogelande to burn all of the letters written by others except the ones that Voetius had written to Mersenne, seeking his allegiance against Descartes, so that there would be evidence of Voetius's slander. However, he left it to Van Hogelande's

¹⁰⁴ AT V 430, CSMK 383.

¹⁰⁵ AT V467, CSMK 383–84.

discretion what to do with the other material, including letters Descartes wrote.¹⁰⁶ Given Descartes' rejection of the occult, it would be wrong to say he had a "premonition" of his death; rather, he was aware of the danger involved in the journey and the threat that the harsh Swedish winter posed to his health.¹⁰⁷ Christina seemed to be alive to the latter as well, or at least was concerned about Descartes' legacy, for before he fell ill she had asked him to put his papers in order. Fortunately for us, he complied, and these documents were delivered by Chanut to Clerselier, who edited the first edition of Descartes' correspondence in three volumes (1657, 1659, and 1667) and also saw to it that *The World* (1677) and the *Treatise on Man* (1664) were published.

Because he was Catholic and Sweden was a Lutheran country, Descartes was initially buried in a cemetery designated for orphans who died before baptism. This ran contrary to Christina's wishes, and something Descartes would have considered a great indignity, but Chanut thought it was the only way to avoid rumors that he had converted. However, Descartes' body continued the practice that he began while he was alive of changing residences frequently. As the result of efforts by his supporters, a decision was made to exhume his remains and return them to Paris, where they arrived in January 1667. They were moved six months after arrival and then again in 1792 and 1819, to rest finally within the nave of the Church of Saint Germain-des-Prés between two famous Benedictines. The history of Descartes' skeleton is made more complex, however, by the fact that it was dismembered on its travels. When it was originally exhumed in Sweden, the skull and the forefinger of the right hand were removed. The former was resold several times and now, supposedly, is housed at the Musée de l'Homme in Paris, though its authenticity is suspect. The saga of Descartes' remains seems to confirm, in macabre fashion, his view that matter is imminently and indefinitely divisible. In 1793 there were plans to move Descartes' remains to the Panthéon in Paris, where other famous French philosophers such as Rousseau and Voltaire are entombed in great splendor, but these did not come to pass. The modesty of Descartes' resting place reflects his own ambivalence about France and the Catholic Church and, conversely, that of the church toward him.¹⁰⁸

¹⁰⁶ AT V 410. Incidentally, we know that Van Hogelande did not burn all of the letters in the trunk, and he may not have destroyed any. See Theo Verbeek et al., ed., *The Correspondence of René Descartes 1643* (Utrecht, 2003), xii.

¹⁰⁷ In the March 1649 letter to Chanut just cited, Descartes expressed fear that he could lose his life in a shipwreck en route to Sweden (AT V 329, CSMK 371).

¹⁰⁸ Clarke 2006, 412.

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Written by one of the editors of the canonical edition of Descartes' *oeuvres* with special insight into the Cartesian system. Helpful on Descartes' early life and a strong improvement over Baillet 1691, but lengthy and available only in French.

Baillet, Adrien. 1691. *La vie de Monsieur Descartes*, 2 vols. Paris (reprint, New York: Garland, 1987).

The best and most complete of the early biographies. Still the main source of our knowledge of Descartes' life since Baillet had access to documents that are no longer extant, but it suffers from two weaknesses: first, he was a hagiographer and so tends to idealize his subject. Second, and more troubling, where he lacks information about Descartes' life, he sometimes conjectures or embellishes. See Rodis-Lewis 1999 and Sebba 1982 as correctives.

Borel, Pierre. 1656 (1653). *Vitae Renati Cartesii summi philosophi compendium*. Paris. Has the virtue of being written shortly after Descartes' death but incomplete. Cf. Lipstorp 1653.

Clarke, Desmond. 2006. *Descartes: A Biography*. Cambridge: Cambridge University Press. Along with Gaukroger 1995, one of the best biographies of Descartes in English – accurate, historically informed, and very readable. Clarke is a keen judge of Descartes' character and motivations.

Gaukroger, Stephen. 1995. *Descartes: An Intellectual Biography*. Oxford: Clarendon Press. Along with Clarke 2006, one of the best biographies in English. Both biographies discuss Descartes' science and mathematics, but Gaukroger delves more deeply into the technical details.

Grayling, A. C. 2005. *Descartes: The Life and Times of a Genius*. New York: Walker.

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Haldane, Elizabeth S. 1905. *Descartes: His Life and Times*. London: John Murray.
Valuable but less lively than other options.

Lipstorp, Daniel. 1653. *Specimena Philosophiae Cartesianae*. Leiden.
One of two early sketches of Descartes' life (published three years after his death) from which Baillet drew but ultimately surpassed in his more complete biography. Cf. Borel 1656.

Rodis-Lewis, Geneviève. 1999. *Descartes: His Life and Thought*, trans. J. M. Todd. Ithaca: Cornell University Press.

Written by one of the leading French scholars in the latter half of the twentieth century, this biography – though very fine and highly recommended – is not for the uninitiated, for it sometimes assumes knowledge of Descartes' life and sees its task as correcting the errors of earlier biographers, especially Baillet. Cf. Sebba 1982.

Sebba, Gregor. 1982. "Adrien Baillet and the Genesis of His *Vie de Monsieur Descartes*," in *Problems of Cartesianism*, ed. T. Lennon, J. M. Nicholas, and J. W. Davis. Kingston, Ontario: McGill-Queen's University Press, 9–60.

A discussion of the origin of Baillet's biography and a balanced assessment of its reliability. Cf. Rodis-Lewis 1999.

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Vrooman, Jack R. 1970. *René Descartes: A Biography*. New York: G. P. Putnam's Sons.
Lively and readable, but relies heavily on Baillet's biography and so reproduces many of his errors.

Watson, Richard A. 2002. *Cogito Ergo Sum*. Boston: David R. Godine.
Descartes' life told with humor and verve. Watson editorializes about Descartes' less desirable traits and chides Baillet, Clerselier, and other members of the "Saint Descartes Protection Society," but this adds to the charm.

ENTRIES

ABSTRACTION VERSUS EXCLUSION

The distinction between the mental operations of abstraction and exclusion plays an important part in Descartes' philosophical methodology. He does not give an explicit account of this distinction in any of his published works, though he does explain it in a letter to **Gibieuf** of January 19, 1642 (AT III 474, CSMK 201), and he touches on it in a letter to **Mesland** of May 2, 1644 (AT IV 129, CSMK 236).

In the case of abstraction, we focus our attention on *one* **idea**, while turning our attention away from the contents of a richer idea of which it is a part. For example, we focus our attention on the **shape** of some object, while turning our attention away from the **extension** of the object. We can tell that this operation is an abstraction from the fact that we can focus our attention on the shape without paying any attention to the extension, though we cannot without absurdity *deny* that the shape has that extension or that the extension has that shape. In the case of exclusion, by contrast, we focus our attention on *two* ideas, and *deny* the one of the other. We can focus our attention, for example, on the **thought** and extension of some **human being**, and deny that the thought is extended and that the extension is thought. We can tell that this operation is an act of exclusion by the fact that we can deny the one of the other without absurdity. Descartes sometimes calls exclusion "negation."

For Descartes, the operation of exclusion is an indispensable instrument for determining the connections between ideas and the items they stand for. If we can mutually exclude the idea of an *F* and the idea of a *G*, then there is a real distinction between an *F* and a *G* in the sense that an *F* can exist independently of a *G*, and vice versa. If we cannot make this mutual exclusion, then there is only a modal distinction or a conceptual distinction between an *F* and a *G*, and the ideas of *F* and *G* can be distinguished only by an abstraction (see **distinction [real, modal, rational]**).

The operation of exclusion plays a crucial part in Descartes' argument in the Sixth Meditation that he is really distinct from his **body** and can exist without it. He states, "I have a clear and distinct idea of myself, in so far as I am simply a thinking, non-extended thing" (AT VII 78, CSM II 54). He forms this idea, not by an abstraction from the richer idea of himself as a human being – that is, a thinking and extended thing – but by an exclusion from the idea of his own **mind**, for he can deny without absurdity that he is extended. If he had formed this idea by an abstraction, then the distinction between his thinking and his extension might be only a modal distinction or a conceptual distinction, but since he has formed this idea by an exclusion, the distinction between his thinking and his extension is a real distinction, and hence he can exist without his body. In the *Principles of Philosophy*, he formulates this argument explicitly in terms of exclusion (AT VIIIa 29, CSM I 213).

Whereas Descartes' *ability* to perform an exclusion is crucial to his argument for the real distinction between himself and his body, his *inability* to perform an exclusion is crucial for other important arguments in the *Meditations*, such as the argument for his **existence** (see *cogito ergo sum*), the argument for his being a thinking thing (see **thought**), and the argument for the existence of **God** (see **ontological argument**). Let us consider these arguments in turn.

In the First Meditation, Descartes resolves to suppose that all his former beliefs are false, and in the Second Meditation he tries to carry out this resolution where the belief, "I exist" is concerned, but he recognizes that he is not able to carry it out. He recognizes, in other words, that he cannot without absurdity *deny* that he now exists – that is, he cannot *exclude* existence from the idea of himself. He concludes, therefore, that he exists. He goes on to investigate what he (this "I") is, and, in accordance with his resolution, he rejects all the things he can without absurdity deny that he is, such as that he is a man or that he has a body, but he recognizes that he cannot without absurdity deny that he is now thinking. He cannot, in other words, *exclude* the **attribute** of thought from the idea of himself. He concludes, therefore, that he is a thinking thing.

In the Fifth Meditation, Descartes argues that, from the fact that he cannot think of God except as existing, it follows that existence is inseparable from God (AT VII 67, CSM II 46). He cannot think of God except as existing in the sense that he cannot without absurdity *deny* that God exists, since existence is part of God's **essence**. He cannot, in other words, exclude existence from the idea of God. He concludes, therefore, that God exists.

Whereas Descartes' argument that he is really distinct from his body can be called "an argument from *successful* exclusion," his arguments that he exists, that he is a thinking thing, and that God exists can be called "arguments from *failed* exclusion." Moreover, just as an argument from successful exclusion gives us a real distinction, so an argument from failed exclusion gives us a modal distinction or a conceptual distinction.

See also Attribute; Clarity and Distinctness; *Cogito Ergo Sum*; Distinction (Real, Modal, and Rational); Dualism; Extension; God; Ontological Argument; Thought

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DUGALD MURDOCH

ANALOGY

IN THE *Private Thoughts* (1619–22), Descartes stipulates that "man has **knowledge** of natural things only through their similarity [*per similitudinem*] to the things which come under the senses. Indeed, our estimate of how much **truth** a person has achieved in his philosophizing will increase the more he has been able to propose some similarity between what he is investigating and the things known by the senses" (AT X 218–19, CSM I 5; modified). By this measure, Descartes became a very accomplished philosopher, for in his published and unpublished work he frequently uses analogies between what comes "under the senses" and "natural things." Specifically, Descartes' analogies identify similarities between the effects of observable phenomena and processes, whose **causes** we know, and natural effects, whose causes we do not know. By way of his analogies, Descartes discovers or makes plausible the existence of specific unobservable natural causes and thereby provides a causal **explanation** in **physics**.

Although analogical reasoning is just one component of Descartes' scientific **method**, which may be characterized as a version of hypothetical deduction minus careful confirmation (see Clarke 1982, Sakelleriadis 1982, and McMullin 2008 and 2009), it is with his analogies that Descartes bridges the gap between the world of experience and the moving and colliding particles at the microscopic level that ultimately explain the effects we observe. Yet Descartes rarely used the Latin term from which our "analogy" derives, let alone its French cognate *analogie* (cf. AT XI 158; see Galison 1984). The analogies from the *Dioptrics* (1637) that I discuss here are "comparisons" (*comparaisons*), and those from the *Meteors* (1637) are instances

of reasoning by “example and similarity” (*exemplum & similitudinem*) (AT VI 83 and I 422, respectively). In the *Principles* (1644), analogies are typically “comparisons” (*comparationes*) or efforts to “compare” (*consero/comparo*) (e.g., AT VIIIA 87 and 110, respectively). In the famous Rule 8 from the *Rules for the Direction of the Mind* (1620s), Descartes’ method does not involve seeking “analogies” but advises us to “enumerate all the other natural powers so that, by means of knowledge of some other one, [we] might come to understand [the action of **light**]..., at least by imitation [*imitationem*]” (AT X 395, CSM I 29).

Descartes’ first public expression of his scientific views in 1637 gives analogies a prominent role in physics that would resurface in parts II and III of the *Principles*. When discussing light in the *Dioptrics*, for example, Descartes likens visual **sensation** to the sensory experience of blind men who “see with their hands” in order to make plausible his hypothesis that light is “nothing other than a certain movement, or very rapid and lively action, which passes to our eyes through the medium of the air and other transparent bodies.” He goes on in the *Dioptrics* to analogize light’s propagation to the movement of fermenting wine within a vat, which helps us understand instantaneous propagation in all directions, and to tennis balls ricocheting off a surface or breaking through a sheet, which makes plausible a materialist account of light’s reflection and refraction (AT VI 83ff., CSM I 153–64). In the *Meteors*, Descartes even uses an analogy between a raindrop and a round “flask” filled with water in order to facilitate his optical experiments (AT VI 325).

One of Descartes’ readers, **Jean-Baptiste Morin**, recognized Descartes’ reliance on analogies in the *Discourse* and its companion essays, and in 1638 Morin challenged his use of them (AT II 291 and 297). In response, Descartes concedes that he had used analogies to answer difficult questions in physics but then offers a strong defense of this strategy:

True, the comparisons [*comparaisons*] that are usually employed in the Schools explain intellectual matters by means of physical ones, **substances** by means of accidents, or at any rate, one quality by means of a quality of a different kind, and they are not very instructive. But in the comparisons [*pource qu’en celles*] which I employ, I compare **motions** only with other motions, or **shapes** with other shapes; that is, I compare things that are too small to be perceived by the senses with other things that can be so perceived, the latter differing from the former simply as a large circle differs from a small one. I maintain, therefore, that comparisons of this sort are the most appropriate means available to the human mind for laying bare the truth in problems of physics. I would go so far as to say that, when someone makes an assertion concerning **nature** which cannot be explained by any such comparison [*qui ne peut ester expliquée par aucune telle comparaison*], I think I have demonstrative knowledge that the point is false. (AT II 367–68, CSMK 122; modified)

Setting aside the veracity of Descartes' charge against the "Schools," he is making two noteworthy claims about his analogies in this passage. First, he is insisting that his analogies provide sufficient evidence for making a causal claim. More specifically, they are informative and relevant because they are confined to the same ontological category. But what is unstated in the letter to Morin, just as it was unstated in the *Discourse's* companion essays, is Descartes' ontology and his conception of matter as **extension**. It is because matter is just extension that Descartes is so confident his analogies will not mislead us. In particular, worries that inferences to unobserved causes will involve false generalizations – including generalizations about the scope of the **laws of nature** – can be ignored because we are simply comparing one instance of extension with another, which is not unlike comparing "a large circle ... [to] a small one."

Second, Descartes insists that analogies are also *necessary* in physics. Lacking an analogy of the sort he advocates, Descartes believes that we have a definitive reason to reject any proposed causal explanation – that is, the cited cause is either nonexistent or outside of nature. This suggestion is especially unacceptable to Morin, whose deep disagreement is evident in his next letter to Descartes (AT II 411). But what Morin never came to understand is that Descartes' view is not, simply, where there is a cause, there will be an analogy. Rather, Descartes' view is that where there is just extension, there will always be an analogy to aid in the discovery of an unknown cause or to show the plausibility of a given cause.

Descartes would go on to make this last point again in the *Principles*, but his ontology would be more explicit:

I ... acknowledge that I recognize no matter in corporeal things apart from that which the geometers call quantity ... i.e. that to which every kind of division, shape and motion is applicable. Moreover, my consideration of such matter involves absolutely nothing apart from these divisions, shapes and motions.... And since all natural phenomena can be explained in this way ... I do not think that any other principles are either admissible or desirable in physics. (AT VIIIA 78–79, CSM I 247)

If something is entirely unlike shape, size or motion, it will not enter into Descartes' physics. Whereas Morin, like the Scholastics, accepts a plurality of ontological categories and even occult qualities, Descartes does not. For Descartes, explanations without possible analogs elsewhere in nature run afoul of an immediate consequence of the **metaphysics** that is the foundation of his physics.

In the years after his death, Descartes' analogies were ridiculed as instances of his worst "speculative" inclinations and therefore wholly without merit when observation and experimental science became the benchmark of science. Advances in microscopy alone were enough to undermine the particular claims Descartes had

used his analogies to support. To Descartes' early detractors, his analogies typified everything that was wrong with the Cartesian research program in science, which was portrayed as constrained only by the limits of Descartes' imagination and bolstered by his deluded faith that he saw clearly and distinctly into how nature functions (see Lauden 1966 and especially Anstey 2005). But as imaginative and implausible as Descartes' analogies often are, in truth they are just one part of a metaphysical physics where the identity of extension and matter serves to constrain admissible truths and practices.

The role of metaphysics in Descartes' use of analogy might suggest that we should take a negative view of Descartes' analogies, but our final judgment of the role he assigned to analogies should not be entirely negative. The epistemic virtues of unity and simplicity touted by philosophers and scientists today support Descartes' belief that lacking an analogy between a proposed cause and other causes in nature requires a choice of endorsing the existence of the new cause or maintaining the ideals of unity and simplicity. If we are willing to allow these ideals to go proxy for Descartes' metaphysics, though Descartes himself seems to have done just the opposite, we can see that science has remained deeply Cartesian. And even if Descartes proved willing to judge in favor of these ideals to the point of stifling research into natural causes, his use of analogy, though not his specific analogies, is both well conceived and defensible (see Manning 2012, Statile 1999).

See also Cause; Explanation; Law of Nature; Metaphysics; Method; Morin, Jean-Baptiste; Nature; Optics; Physics; Sensation

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GIDEON MANNING

ANALYSIS VERSUS SYNTHESIS

In Second Replies, Descartes draws a distinction between two **methods** of demonstration: analysis and synthesis. He nowhere offers a formal **definition** or account of the two methods, but he does make claims throughout his corpus, but especially in the Second Replies, that provide important clues as to the details of their nature. For example, he identifies analysis as a method of instruction, and he says that indeed it "is the best and truest method of instruction" and is the method that he employs in the *Meditations*. He says that synthesis "is very suitable to deploy in **geometry**" (AT VII 156, CSM II 111) and that it characteristically involves the presentation of a series of definitions, postulates, axioms, and theorems that together form a deductive chain of reasoning that forces even the most stubborn of **minds** to affirm its conclusion (AT VII 156, CSM II 110–11) (see **deduction**). He makes additional claims as well: that analysis is a version of a method that was highly regarded in ancient geometry; that it helps us to have clear and distinct **perceptions** of the primary notions of **metaphysics**; and that it is a method of discovery (AT VII 155–57, CSM II 110–12). He says that synthesis and analysis are complementary methods but one difference is that a successful analytic demonstration does not compel our assent (AT VII 156, CSM II 110–11).

Descartes draws a further distinction between the *method* of demonstration and the *order* of demonstration. Both analysis and synthesis must employ the proper order: claims that are put forward initially cannot depend for their support on claims that come later, and claims that are derived thereafter must depend solely on claims that have already been established (Gueroult 1984, 1:8–11). Descartes emphasizes that in the *Meditations* he tried to adhere to this order: in the First Meditation he refrains from affirming claims that are dubitable, and

when he does finally stand behind metaphysical principles, they are either primary notions that are known through themselves or the conclusions of arguments whose premises comprised such notions (AT VII 155, CSM II 110). Any method must adhere to the proper order, and so it is in other respects that analysis and synthesis diverge.

Descartes says that synthesis is very suitable to employ in geometry. We might attempt to prove, for example, that when two parallel lines intersect with a third line, the resulting internal angles add to 180 degrees. The assent-compelling proof would include among its premises the definition that a straight line has 180 degrees and the axiom that when two parallel lines intersect, opposite angles are equal. Descartes' stated preference is not to use the synthetic method in demonstrating metaphysical results, although he relents when the authors of the Second Objections suggest that the results of the *Meditations* would be more conspicuous if presented *more geometrico* (AT VII 155, CSM II 110; AT VII 128, CSM II 92). In the **Geometrical Exposition**, appended to the Second Replies, Descartes lays out definitions and axioms and then uses them as premises in syllogistic arguments for the **existence of God**, the existence of the heavens and earth, and the real distinction between mind and **body** (AT VII 166–70, CSM II 117–20). He also appears to employ a hybrid version of synthesis (and analysis) in *Principles of Philosophy* (Garber and Cohen 2000, 52–63).

One reason Descartes does not like to use synthetic demonstrations to establish metaphysical results is that he thinks that the definitions and axioms of metaphysics are too difficult for most untutored intellects to fully apprehend. Axioms about parallel lines and the lines that intersect them are fairly intuitive, and they accord very well with everyday sensory experience, but “in metaphysics by contrast there is nothing which causes so much difficulty as making our perception of the primary notions clear and distinct” (AT VII 157, CSM II 111). A metaphysician certainly could produce arguments for metaphysical results – like that God exists, or that bodies exist, or that mind and body are really distinct – but these arguments would be of little help to us if we did not understand their premises (Curley 1986, 154; Hatfield 1986, 71). Accordingly, a component of Descartes' analytic method is to help us to recognize the **truth** of metaphysical premises that upon reflection are obvious, even if they appear to be controversial or false at first glance (AT VII 156–57, CSM II 111). The primary notions of metaphysics include that nothing comes from nothing, that it is impossible for the same thing to be and not be at the same time, that what is done cannot be undone, that he who thinks cannot but exist while he thinks (AT VIIIA 23–24, CSM I 209; AT VII 145–46, CSM II 104) (see **common notion**). The primary notions also include results that might appear to be more derivative but that (Descartes argues) are obvious to a mind that has reflected sufficiently (AT VII 69, CSM II 47). Primary notions are not

known through the senses, but they are known, and they are demonstrated. What is curious is how exactly an analytic demonstration is supposed to be structured if its conclusion is a truth but, unlike the conclusion of a synthetic demonstration, is not a matter of “the proper deduction of the consequences” (AT VII 157, CSM II 111) and “is not contained in what has gone before” (AT VII 156, CSM II 111). Presumably we would want there to be that kind of connection between a demonstration’s conclusion and its premises, but if a primary notion were demonstrated in that way, then its demonstration would not be analytic (Gaukroger 1989, 85–88). For Descartes, a primary notion appears to be primary or fundamental in the sense that it is not contained in anything else and does not follow from anything else (AT VII 140, 145–46; CSM II 100, 104), and so a synthetic demonstration of a primary notion is ruled out from the start. An analytic demonstration is a carefully selected set of claims, a consideration of which happens to facilitate – without irresistibly compelling – our recognition of a primary notion’s primitiveness and self-evidence (Hatfield 1986, 65, 69–71). Once we do recognize the truth of a primary notion, we can then use it as a premise in a synthetic demonstration, but we would have little chance of following the demonstration if it was presented to us cold and in isolation.

As we have seen, Descartes regards analysis as a method of instruction, and he uses it to help us to recognize the necessity of metaphysical claims that we might otherwise reject as false. We reject these, Descartes thinks, because we are in the **habit** of affirming entrenched philosophical **prejudices** that oppose them (Nolan 2005); if we appreciate the relative perspicuity of the primary notions of metaphysics and the truths that they entail, and if we develop the opposite habit of allowing these notions to guide our thinking instead, our prejudices will be neutralized (AT VII 157, CSM II 111; AT VIIIA 38, CSM I 221; Cunning 2010, ch. 1). Descartes tells **Arnauld** that the analytic method is in part a matter of advancing claims that are false and reevaluating and refuting them later (AT VII 249, CSM II 173). Commentators have attempted to arrive at a general characterization of Descartes’ analytic method by appealing to all of the different claims that he makes about it and then looking for instances in which the method (so described) is at work in the *Meditations*. Curley (1986, 157–62) argues that the method is a matter of leading the meditator to explore and unpack his confused concepts and, by exposing their inherent problems, to clarify them and then see the truth for himself. Curley points out the important connection here between analysis and Socratic dialectic: the First Meditation appears to be cast as an imaginary debate that exposes the problems inherent in a commonsense representation of reality and points the way to a representation that is sustainable. Hatfield (1986, 45–48) argues that the method is a matter of making us have first-person experiences that increase the likelihood that we will recognize that intellectual perception is a better guide to truth than sensory perception and then

recognize the truth of particular intellectual notions. Garber (1986, 91–97) argues that the method is a matter of employing heuristic devices that neutralize prephilosophical commitments as they interfere with our ability to register the proper foundations of science.

One such instance of pedagogical intervention occurs in the **wax** digression at the end of the Second Meditation. Descartes' meditator has just arrived at the result that there is something about which we are indubitably certain, and something that "is necessarily true whenever it is put forward by me or conceived in my mind" (AT VII 25, CSM II 17). If the meditator entered the *Meditations* with the view that what is known best is known through the senses (Garber 1986, 99–101), or the view that the only things that are real and substantial are sensible objects – and Descartes thinks that the prephilosophical mind is likely to harbor both of these prejudices (AT VIIIA 35–37, CSM I 218–20) – he will wonder if he can really be certain of the real existence of anything nonsensible (AT VII 29–30, CSM II 20). Descartes offers the wax discussion to help the meditator to see that there is an insensible component to bodies and that we know it better than we know qualities like color and taste and smell (AT VII 30–32, CSM II 20–22; Curley 1986, 158–59). Descartes asks the meditator to consider a piece of wax that has such qualities, but of course bodies do not literally have them, at least not in the way that most readers would imagine (AT XI 31–36, CSM I 90–92). This thought experiment helps us to appreciate that our purely intellectual and nonsensible **thought** is real and that its existence is indubitable (Cunning 2010, ch. 3).

A similar pedagogical move is at work in Descartes' introduction of hyperbolic **doubt** at the start of the *Meditations*. In the First Meditation, the meditator entertains claims that contradict necessary truths. These claims include that it is possible that God does not exist and that our minds were produced by a nondivine **cause**; that it is possible that God is a deceiver and has created us with minds that are defective; and that it is possible that there exists an evil demon who makes us think that things are true when they are in fact false (AT VII 21–23, CSM II 14–15). All of these claims conflict with the necessary truth that God exists and would not allow us to be deceived on matters that are most evident to us. We recognize this to be a necessary truth upon reflection, and thus the claims that conflict with it are incoherent, but at the start of inquiry it is useful for us to entertain the claims so that we can recognize the truth of the wholly insensible result that "I am, I exist" at the start of the Second Meditation (AT VIIIB 60, CSMK 222; Curley 1986, 167). The hypotheses of the First Meditation are fictional, but Descartes has us consider them because they help motivate the kind of premise that is appropriate in a synthetic metaphysical argument (AT IV 64, CSMK 230). Descartes is happy to make use of confused concepts in the course of presenting and defending his metaphysics. If our concepts were intrinsically and irretrievably confused,

there would be no point in using them as epistemic starting points, but Descartes locates a route from the confused concepts that we actually have to concepts that are distinct.

Some commentators have focused on the *Meditations* to extract a more general understanding of Descartes' analytic method, but others have looked to his earlier writings on method and in particular to his geometry. These commentators emphasize that Descartes identifies his analytic method with the analytic method of ancient geometry, and then point to ways in which the two methods are similar. Hintikka (1978, 80–83) argues that the analytic method in ancient geometry consisted in large part of putting forward thought experiments that expose the conceptual interconnections between the properties of geometrical figures and that thereby expose which properties of a figure are essential to it and which are not. Hintikka argues that the wax discussion involves such a thought experiment: we learn that qualities like sound, taste, and color are not essential to bodies and that qualities like **extension** are. Very generally, Hintikka sees the *Meditations* as a project of locating unanalyzed **ideas**, breaking them down into their parts, and noticing which parts of an idea are interdependent and which are not.

More recently, Smith (2010, 31, 71) has argued that for Descartes analysis is a matter of partitioning ideas into a hierarchy of sets that enumerate the elements that ideas have in common and the elements that they do not. For example, ideas of triangles and circles all fall under the general umbrella category of extension, whereas ideas of volitions, **sensations**, and ideas fall under the category of thought, but even though triangles and circles both are extended, triangles are rectilinear and circles are not, and so things that can be sorted under the same umbrella category can be differentiated into further subcategories still (ibid., 104–9). When we partition our ideas, we are able to notice what specifically they have in common and what they do not. We are able to notice for example that minds, volitions, colors, and tastes are not extended and that, even though triangles and circles are extended, there are still important respects in which they differ. Smith (2010, 110–12) understands analysis in terms of partitioning, and then he looks to the *Meditations* for instances in which ideas are partitioned – for example, the sorting in the First Meditation of things that are known through the senses and things that are not (AT VII 18–21, CSM II 12–14) (see **enumeration**); the sorting in the Third Meditation of ideas into the categories of innate, adventitious, and invented, and the further division of innate ideas as a function of the degree of objective reality that they contain (AT VII 37–45, CSM II 25–31) (see **being, formal versus objective**); and the sorting in the Sixth Meditation of the different possible causes of our sensations (AT VII 79–80, CSM II 55). One problem for both Hintikka and Smith is that there appear to be instances in the *Meditations* where Descartes deploys the analytic method but

is not breaking down concepts or partitioning. Smith (2010, 112) acknowledges that there might be more than one method at work in the *Meditations*, though Descartes does say that it is the method of analysis alone that he employs there (AT VII 156, CSM II 111). Perhaps he is overstating things and the *Meditations* makes use of additional methods, or perhaps there is a way to understand all of the pedagogical maneuvers of the *Meditations* as instances of analysis as Hintikka and Smith characterize it.

See also Deduction, Habit, Idea, *Meditations on First Philosophy*, Metaphysics, Method, Prejudice, Wax

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ANATOMY AND PHYSIOLOGY

From his first book published in 1637, the *Discourse on Method*, to his last book issued in November 1649, the *Passions of the Soul*, Descartes showed a constant interest in questions of anatomy and physiology. In *Discourse V*, he explains the difficult question of the movement of the **heart** and refers favorably to **Harvey**'s recent discovery of the circulation of blood (1628). The *Dioptrics* discusses the eye, focusing on the optic nerve and explaining the structure and use of the nerves (discourses III and IV). The first part of the *Passions* contains a summary of Descartes' mechanical physiology as detailed in posthumously published texts: the *Description of the Human Body* (AT XI 223–86, extracts CSM I 313–24), an updated version of the *Treatise on Man* (AT XI 119–202, extracts CSM I 99–108). In the *Description of the Human Body*, Descartes mentions the lacteal veins and the demonstration of their existence by Asellius (Aselli) (AT XI 267) in his study of the complex question of the formation of the **animal**, where he insists on the formation of the heart and on the importance of the blood and the animal spirits. The *Meditations* and the *Principles* also tackle medical issues. The First Meditation alludes to melancholia, an important pathology in the seventeenth century, as evidenced by the **correspondence** with **Princess Elisabeth**. The Sixth Meditation introduces innovations in the analysis of pain and of the phantom limb syndrome (see **sensation**), which in no way affects the unity of the soul. The *Principles* IV.196, echoing a letter to **Plempius** (AT I 420, CSMK 64), gives an illustration that expands on the analysis of sensation given in the *Dioptrics*.

After the publication of the *Discourse*, Descartes discussed medical issues with qualified physicians, as letters to **Plempius**, **Regius**, **Meyssonnier**, and **Vorstius** illustrate. Harvey himself acknowledged the Cartesian analysis of the **motion** of the heart and, invoking accurate observations, elegantly rejected it (Second Reply to Jean Riolan [the Younger], 1649). This is remarkable because Descartes did not study **medicine** in a university. But when, at the end of 1629, he decided to study anatomy to write the *Treatise*, a part of *The World*, he read several books on the subject and performed **experiments** on various **animals**. Descartes' anatomical sources were "Vesalius and the others" (AT II 525, CSMK 134). Among "the others," the most important anatomist was Caspar Bauhin, who used Vesalius's illustrations and updated some in his treatise *Theatrum anatomicum* (Frankfurt, 1605, 1620–21). These anatomical drawings helped Descartes to perform dissections, mainly of the hearts and the brains of calves, oxen, and lambs, as can be seen with the Latin *Notes* (*Excerpta anatomica*) about anatomical experiments (AT XI 549–635). As he was dissecting hearts, Descartes carefully studied the pericardium, the coronary vessels, and the cardiac nerves. He paid great attention to the anfractuosities in the ventricles of the heart, to the fleshy columns, and to the insertions of the aorta and the pulmonary artery, as well as to the vena cava and the pulmonary veins. He also investigated the

thick structure of the septum, the more important thickness of the left ventricle, the cardiac valves, and the remnants of the union of the vessels in fetal hearts, anatomical structures that were debated and became conclusive proofs in favor of the circulation of the blood in Harvey's treatise. Descartes showed great interest in the valves of the veins, discovered by Fabricius of Aquapendente (*De venarum ostiolis*, 1603), promoted by Caspar Bauhin (*Theatrum anatomicum*, 1605), and whose function was brilliantly demonstrated by Harvey (*De motu cordis et sanguinis*, ch. 13). In the brains he dissected, Descartes paid attention to the blood vessels and to the structure of the nerves and their origins, with a special interest in the optic nerves, to the **pineal gland** and pituitary gland. Some passages mention the correspondences between organs: for instance, the "penis of the brain" being the pineal gland. Descartes also dissected lungs and livers and studied the formation of the fetus of the chick in the egg, repeating experiments made by Aristotle and Fabricius of Aquapendente (*De formatione ovi et pulli*). Additionally, he performed dissections of **animal** fetuses to observe the order in which the organs arise during gestation. He focused on the fetal membranes and placenta as well as on the vessels of the umbilical cord. His *Primae cogitationes circa generationem animalium* (AT XI 505–38) shows the influence of Fabricius of Aquapendente (AT IV 555) and of Harvey for the heart in the embryo representing the beginning of life. But Descartes rejected the teleological assumptions about nature that were common in anatomy and that Harvey still makes in his treatise. This is obvious in his treatment in the *Discourse* of the cardiac valves ("the eleven little membranes"), the number of which is explained by mechanical reasons due to their structure and their distribution in the heart (AT VI 47–48, CSM I 134–35). Thus, Descartes discards the respectful attitude toward the skills of nature that is paramount in Harvey's treatise.

Descartes makes a major breakthrough in physiology with the rejection of **explanations** in terms of "**faculties**," as used by the Scholastics and by Renaissance anatomists. This rejection is associated with Harvey's discovery of the circulation of the blood and with a Cartesian mechanistic explanation of the heat of the heart understood as the "principle of life" (AT XI 202, CSM I 108; AT XI 407, CSM I 366). Descartes suggested an explanation of biological functions "only from the disposition of their organs" from the *Discourse* (AT VI 57, CSM I 140) to the *Passions*. To explain the disjunction between the soul and vital phenomena that characterizes Cartesian mechanistic physiology, Descartes assumes in the **body** the famous "fire without light" whose nature is reduced to fermentation (AT VI 46, CSM I 134; AT XI 231–32). The body is ruled by "the laws of mechanisms, which are identical with the **laws of nature**" (AT VI 54, CSM I 139), and it is given life by the heat in the heart. The soul is no longer a principle of life, and death "never occurs through the absence of the soul" (cf. AT XI 330–31, CSM I 329–30).

Descartes dissociates the heart from the soul and says nothing about the heart-sun or microcosmic analogies, while Harvey still makes use of these common metaphors in medicine at key moments in his arguments. Physicians who

wrote about the parallel between the sun and the heart generally called upon “the Ancients” (cf. Laurentius’s *Historia anatomica*) and maintained the traditional geocentric universe. In medicine, this parallel lends support to a **cosmology** derived from the Greek legacy, but Descartes followed the “new astronomers” (Copernicus and **Galileo**) in *The World*.

For Descartes, the well-being of the body depends on the heart and blood (*Passions*, I.71, AT XI 381, CSM I 353) – hence, the importance of these questions in his works. In the *Discourse*, Descartes agrees with Harvey about the circulation of the blood and quotes with approval the latter’s experimental proofs. But he does not mention the reference to the Aristotelian weather cycle, which gave birth (according to Harvey, in chapter 8 of *De motu cordis et sanguinis*) to the **definition** of the circular movement of the blood in living creatures. Whereas Harvey believed in the **analogies** between the world as a cosmos and man, Descartes separated the experimental proofs given by the English physician from the vitalistic background.

Descartes did not agree with Harvey on the **cause** of the movement of the heart. His own chronology of the phases of the cardiac cycle is in accordance with the explanation of the origin of heat conceived as the principle of life. In case the expulsion of blood occurs during systole, the phase of contraction of the heart, and thus during its diminution in volume (cf. *De motu cordis*, cap. 2), there must be “some faculty” in the heart that causes this contraction (*Description*, AT XI 243, CSM I 318). Contrary to Harvey, Descartes explained the expulsion of the blood from the ventricles as a kind of natural phenomenon occurring in the blood itself, a process like fermentation, the result of the production of heat in the heart. Therefore, the expulsion of blood must coincide with the expansion and not with the contraction of the heart (cf. AT VI 49–50, CSM I 135–36; AT XI 241–45, 316–19; AT XI 280–82).

Descartes was wrong in his explanation of the movement of the heart, as was shown by Harvey in 1649 and confirmed by Richard Lower in 1669. Descartes supported Harvey’s discovery of the circulation of the blood but replaced his Aristotelian and vitalistic framework with a mechanistic one. This transformation is reflected in **Regius**’s medical theses from 1641 (*Physiologia sive cognitio sanitatis*, Utrecht), and later in his *Philosophia naturalis*, as well as in **Rohault**’s *Traité de physique* (1671, part IV). The Cartesian mechanical account of the circulation of the blood became the prevailing view in France beginning in 1673 with the teaching of Dionis and later his *L’anatomie de l’homme suivant la circulation du sang et les nouvelles découvertes* (1690), which was translated into Latin in 1694, into English in 1703, and into Tatar in 1723 by a **Jesuit** father for the physicians in China.

See also Analogy; Animal; Blood, Circulation of; Body; Cosmology; *Description of the Human Body*; *Discourse on Method*; Experiment; Explanation; Harvey, William; Heart; Law of Nature; Machine; Medicine; Mind; Optics; *Passions of the Soul*; Sensation; *Treatise on Man*

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ANNIE BITBOL-HESPÉRIÈS

ANGEL

In the Third Meditation, Descartes introduces the **idea** of angel as an instance of an idea the human **mind** can form from other ideas, namely from the idea of **human being** and from that of **God** (AT VII 43, CSM II 29; AT VII 138–39, CSM II 99). In the *Conversation with Burman*, Descartes reportedly asserts that he cannot say anything about angels' nature, except that like human minds they are thinking **substances** (AT V 157–58). However, in discussing **Regius's** theory that man is a substance by accident (*per accidens*), Descartes provides one counterfactual detail concerning angelic **knowledge**. The human mind is really and substantially united to the **extension** of his **body**. In consequence of this kind of union, the human mind

perceives the mechanical modifications of his body as obscure **sensations** and **passions**. By contrast, if an angel were joined to a body, his mind would perceive the modifications of this body as they really are, that is, as the mechanical effects of the external bodies that **cause** them. Consequently, he would know the former only through clear and distinct ideas (AT III 493, CSMK 206) (see **clarity and distinctness**). An angel united to a body would realize the kind of union that a pilot bears to his ship, which Descartes opposes to the kind of union that holds in the case of human nature (AT VII 81, CSM II 56). To Burman, Descartes adds that he deems wholly irrelevant what views **Aquinas** – who had been so concerned with angels to deserve to be called “Doctor Angelicus” – held concerning the nature and mind of angels.

Despite this dismissive attitude, Descartes draws on what Aquinas and **John Duns Scotus** say about angels in his account of the human mind and the nature of human knowledge. For example, the following Cartesian claims on the angelic mind can be traced directly to Aquinas:

1. The mind directly knows itself; its nature consists in thinking and hence it always thinks (AT III 478, CSMK 203; AT V 193, CSMK 355 (cf. *Summa Theologica* I, q.56, a.1; q.58, a.1).
2. Understanding and will, and not **imagination** and sensation, pertain to the nature of the mind (AT VII 73, CSM II 51) (cf. *Summa Theologica* I, q.54, a.5).
3. The mind has clear and distinct **perceptions** of the nature of the body and of mathematical **essences** via innate ideas (AT XI 47, CSM I 97) (cf. *Summa Theologica* I, q.57, a.1, a.2; q.84, a.4).
4. Perfect knowledge free from error is the intuitive knowledge to which even the most complex **deduction** can be traced back (AT X 407–10, CSM 37–39) (cf. *Summa Theologica* I, q.57, a.3).

The case of knowledge of God is harder. In fact, the knowledge that angels have of God had been a difficult point in Aquinas and had carried out a major role in the anti-Thomistic theory of knowledge by Scotus. According to Aquinas, the angelic **intellect** is intermediate between human intellect and the intellect of God and the blessed. Therefore, angelic knowledge occupies an intermediate stage between human and beatific knowledge. The human mind knows God indirectly – the direct objects of knowledge are finite beings. The blessed, on the other hand, know God directly and immediately, without the mediation of a concept, as the eye sees **light** immediately. The intermediate stage between human and beatific knowledge would have to be a knowledge that has God as its direct object but that is a mediate one, that is, a knowledge of God by the means of a concept, an **intentional species**. In fact, a species is a means that is not itself an object of **thought**, and for this reason it produces a mediate but direct knowledge of his object. But a central point in the Thomistic theory of knowledge and **metaphysics** is that the infinite, by its nature,

cannot be known in its nature by finite means (see infinite versus indefinite). So a concept, which is finite by nature, cannot represent the infinite. Aquinas tries to solve the difficulty by attributing the knowledge of God that angels have not to a concept but to the image of God inscribed in the nature of the angel itself. Thanks to the similarity with God imprinted in the nature of the angel, the nature of the angel represents God and consequently carries out the same role the species do – that is, it represents directly and mediately the infinite (*Summa Theologica*, I, q.56, a.3). Moreover, an angel knows God by knowing himself, and consequently his knowledge of God is an intuitive one, as Aquinas stresses in *Summa contra Gentiles* (III, 49). But this solution is a very feeble one. In fact, the nature of angels is finite, and as such it is incapable of representing positively the infinite.

By contrast, Duns Scotus, who maintains that a finite concept can represent the infinite, has no difficulty in ascribing to angels an “abstractive” cognition of God, that is, a knowledge by means of a concept. Scotus claims that human and angelic minds share the same nature, a claim that led Descartes to model human knowledge on Scotistic accounts of angelic knowledge of God. In fact, Descartes attributes to human minds a clear and distinct concept representing the nature of God.

Notwithstanding, Descartes shares the anti-Thomistic view that Scotus elaborated about the angelic knowledge of God. When he wants the reader to understand how the human mind can master the idea of God, he replicates a passage in which Aquinas had tried to justify the claim that angels have intuitive knowledge of God, which is achieved through the knowledge angels have of themselves, as would happen if “a box had an intellect and so knew through its form the skilled mind from which such a form proceeded as a likeness of that mind” (*Summa contra Gentiles*, III 49). Descartes presents the same claim in the Third Meditation (AT VII 51, CSM II, 35) and later in the Fifth Replies, where he compares the idea of God to the mark of the craftsman stamped on his work (AT VII 372, CSM II 256). In this way, Descartes uses the texts in which Aquinas had showed that the knowledge angels have of God is an intuitive one and tries to exploit Aquinas’s authority in attributing to the human mind a clear and distinct idea of God, a thesis that Aquinas had always rejected.

See also Aquinas, Thomas; Clarity and Distinctness; God; Human Being; Idea; Infinite versus Indefinite; Intellect; Knowledge; Mind; Regius, Henricus; Representation; Scotus, John Duns; Species, Intentional; Substance; Thought

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EMANUELA SCRIBANO

ANIMAL

Descartes used the word “animal” (Latin *animal*, French *animal*) for animals in general, including **human beings**, and the term “beast” (Latin *bestia* or *brutum*, French *bête*) for nonhuman animals. He developed a new approach to nonhuman animals as mindless **machines**, lacking sentience. In line with the similarity between human and animal bodies (henceforth, “animal” means *nonhuman* animals), he treated the human **body** as a machine as well, albeit ensouled. Descartes recognized that animals behave so as to preserve their bodies in relation to environmental circumstances. His conception of animals as mere machines required that he explain such behavior using material mechanisms alone, in accordance with his doctrine that matter or body (corporeal **substance**) has **extension** as its **essence**, modified only by the properties of size, **shape**, position, and **motion**.

Discussion of animal cognition increased throughout the seventeenth century. Before Descartes’ animal machine hypothesis, debate was focused on whether animals reason. Michel de Montaigne famously argued that human and animal cognition do not differ in kind. **Pierre Charron** held a similar position, sparking a controversy that drew in Marin Cureau de la Chambre, whom Descartes knew in the 1640s, and Pierre Chanet. The latter two authors adhered to the received opinion among Scholastic Aristotelians (see **Scholasticism**) that the cognitive capacities of humans and animals differ in kind. These discussions included both natural history, describing animal behavior, and natural philosophy, seeking to explain those behaviors (Harrison 2004). Descartes focused on the latter, using few examples of animal behavior in his theoretical discussions. His followers, such as **Antoine Le Grand**, tested the animal-machine doctrine against the natural history literature.

Within the Aristotelian philosophy that Descartes knew well, all natural kinds, whether mineral, vegetable, or animal, were constituted by a **substantial form** inhering in matter. This “matter” was not conceived as a stand-alone substance and so is not Descartes’ bare extended corporeal substance. It serves as substrate for the substantial form, which is an active principle that directs the development of each kind of thing toward its characteristic properties. An acorn contains the form of the oak and, in growing, organizes its matter into an oak tree with branches and leaves. Animals, nonhuman and human, have their various

substantial forms, with capacities that guide the animals' behaviors in relation to environmental circumstances.

In this scheme, living things fall under three kinds: vegetable, animal, and human, differing in kind of soul or substantial form. Plants have a vegetative soul, with powers of nutrition, growth, and reproduction. Animals have a sensitive soul, which, for mobile animals, includes the vegetative powers plus sensitive, appetitive, and locomotive powers. Human beings have a rational soul, with all the previous powers plus **reason** or **intellect**.

Adherents to this scheme knew that animal behavior seems to manifest reason or at least a power of cognition. Sheep recognize the danger posed by a wolf. Bees make hexagonal honeycombs. Dogs double back to catch the hare. Animals learn where food is available and return to those spots. Orthodox theorists had to explain these apparently rational behaviors without granting a rational soul to animals. Aristotle and his Scholastic interpreters assigned cognitive powers to the sensitive soul, in particular to the "internal senses." The various schemes of the internal senses typically posited at least **common sense**, **imagination**, and **memory** (Wolfson 1935). The sheep recognizes the wolf as dangerous through an "estimative power," an additional internal sense or a subpower of common sense or imagination (see **sensation**).

The **explanations** for apparently rational behaviors varied. The sheep's recognition of the wolf might result from an innate instinct or from learning (placing in memory a perception of the wolf's damaging behavior on other sheep). With instinct, the animal has no comprehension of why what it does is good; it just does it. In learning, the animal recognizes that something is good or bad through its internal senses. Building a honeycomb is due to instinct. Recalling where the wolf lurks depends upon learning and memory. Dogs learn to recognize who feeds them. Birds build nests by instinct but may learn (remember) where straw is found (see Hatfield 2012).

Descartes engaged these topics as he composed his *Treatise on Man*, beginning in 1630 with revisions in the 1640s (AT V 112, CSMK 329), and he addressed them in other works, including the *Discourse on Method*, *Meditations*, and *Passions of the Soul*. Contrary to the Aristotelians, Descartes allowed only one kind of soul in nature: the human rational soul, possessed of reason and **thought** (AT VI 59, CSM I 141; AT VII 358–59, CSM II 248). He denied feeling and cognition to animals not because he believed that they manifestly lack sentience, but because they lack a rational soul, the only kind of soul he acknowledged. Because animals have no **minds** and minds are required for sentience (bare matter cannot sense), animals have no sentience (AT III 85, CSMK 148).

Descartes was aware that his denial of sentience to animals is counterintuitive. He ascribed the widespread support of animal sentience to a **prejudice** from childhood: since "most of the actions of animals resemble ours," we assume that "they act by an interior principle like the one within ourselves, that is to say, by means of a soul which has feelings and **passions** like ours" (AT II 39, CSMK 99). He

even conceded to **Henry More** that he could not *prove* there is no sentience in animals: “Though I regard it as established that we cannot prove there is any thought in animals, I do not think it can be proved that there is none, since the human mind does not reach into their hearts” (AT V 276, CSMK 365). Still, he held that animals lack “any real feeling or emotion” and are “automatons” (AT II 41, CSMK 100). To More, he wrote that denial of thought and sentience to animals is “most probable” (AT V 277, CSMK 365).

Descartes offered four arguments that animals are not like us in possessing a soul. Two are well known from the *Discourse*. First, animals lack any meaningful use of language. Some mimic the sound of human speech, but “they cannot show that they are thinking what they are saying” (AT VI 57, CSM I 140). To More, he further argues that even though within animal species (e.g., horses or dogs) individuals differ greatly in skill at learning from humans, and even though such animals clearly show that they want to be fed, no animal has ever used “real speech” to communicate its wants, while among humans even the “stupid and insane” can do so because they possess a soul (AT V 278, CSMK 366). Second, although animals exhibit superior skill in some of their actions, such skill is routinized; animals are void of general problem-solving skills like those of humans, which derive from the soul. The superior skills of animals can be attributed to innate mechanisms, just as a watch keeps better time than a minded human (AT VI 58–59, CSM I 141).

The third argument falls under Descartes’ wider argument that replacing substantial forms with bare mechanisms has the virtue of simplicity (see Hatfield 1985, 155). Animal mechanism obviates the need for any “vegetative or sensitive soul” in nature (AT XI 202, G 169; cf. AT VI 46, CSM I 134), leaving only a rational soul for humans. The fourth argument touches on immortality. Animals are denied thought and sentience, because “if they thought as we do, they would have immortal souls like us. This is unlikely, because there is no reason to believe it of some animals without believing it of all, and many of them such as oysters and sponges are too imperfect for this to be credible” (AT IV 576, CSMK 304; cf. AT VI 59–60, CSM I 141). These arguments assume that a mind or soul is needed for sentience and that the cognitive functions of the sensitive soul can be mechanized.

Descartes’ doctrine of animal mechanism was widely debated after his death. Most of his followers interpreted him as denying animal sentience and agreed with him (Rosenfield 1968, appendix, B–D). Others challenged the doctrine, including, besides More, **Gassendi** (who proposed that subtle matter in the brain might have sentience), **Locke**, and **Leibniz** (Rosenfield 1968, pt. 2, ch. 2). Huxley (1884) later saw Descartes’ animal automatism as facilitating a properly physicalist attitude toward living things, such as he promoted in the nineteenth century.

Some scholars urge that Descartes did not himself hold the doctrine. The debate comes down to two questions. First, Descartes ascribes “life and sense” to beasts (e.g., to More, AT V 278, CSMK 366), perhaps denying them only reflective

or judgmental perception (Cottingham 1998). The question is whether in these passages he ascribes anything other than mechanized versions of life and sense (Hatfield 2007). Second, some find it implausible that Descartes thought he could actually explain animal behavior without cognitive notions such as perceptual representation and bare sentence (Gaukroger 2002, 196–213). This challenges the plausibility of Descartes' mechanistic program itself, which we now examine more fully.

The *Treatise* (1664) contains Descartes' most extensive treatment of animal **anatomy and physiology**. It focuses on the human body but covers physiology shared between animal and human (AT II 525, CSMK 134). Descartes supported his denial of vegetative and sensitive souls by advancing mechanistic accounts, as if by clockwork (or hydraulic works), for their functions in the Aristotelian scheme. Accordingly, the *Treatise* offers basic accounts of digestion and the formation of blood (and other works treat nutrition and reproduction, e.g., the *Description of the Human Body*). However, the greater part of the *Treatise* examines motor and sensory functions that would belong to the sensitive soul. Descartes explains the motions and capacities of the human body, conceived (counterfactually) as unensouled and hence as operating mechanistically. Such mechanisms might also explain the behavior of mindless animals, thereby supporting Descartes' claim to account for apparently rational animal behavior without invoking mind.

The scheme for sensory and motor capacities in Descartes' animal is a causal loop. The body is driven by **animal spirits**, subtle and agitated material particles filtered from the blood at the base of the brain. The mass of the brain comprises hollow tubules containing inner filaments. These tubules form a chamber with the pineal gland at the center (see **pineal gland**, Figure 27). The filaments run from the sense organs to this inner chamber. Depending on the presence of physical stimulation to the sense organs, these filaments jiggle open a pattern of tubules, permitting animal spirits to flow from the gland to the openings. The tubules conduct the spirits to the muscles, which inflate like balloons and contract. As spirits bleed out, the muscles go flaccid. In this way, patterns of sensory stimulation control the motions of the machine (Figure 1).

The movements of the machine depend primarily on four factors: current sensory stimulation; innate plumbing of the brain; alterations to the plumbing from previous stimulation; and the character of the spirits arriving from the **heart**, as influenced by recent food or drink and by bodily temperament (AT XI 166–69, 185–96; G 140–42, 157–65). The current pattern of sensory stimulation affects the opening of the tubules as explained. Innate plumbing accounts for what Descartes calls “natural instincts” (AT XI 192, G 163). These **cause** animals to avoid harms and to seek what is beneficial to the body. The third factor, acquired alterations to the plumbing, falls under “memory.” Descartes describes a brain mechanism that forms associative connections among memory traces (Figure 2), so that if patterns

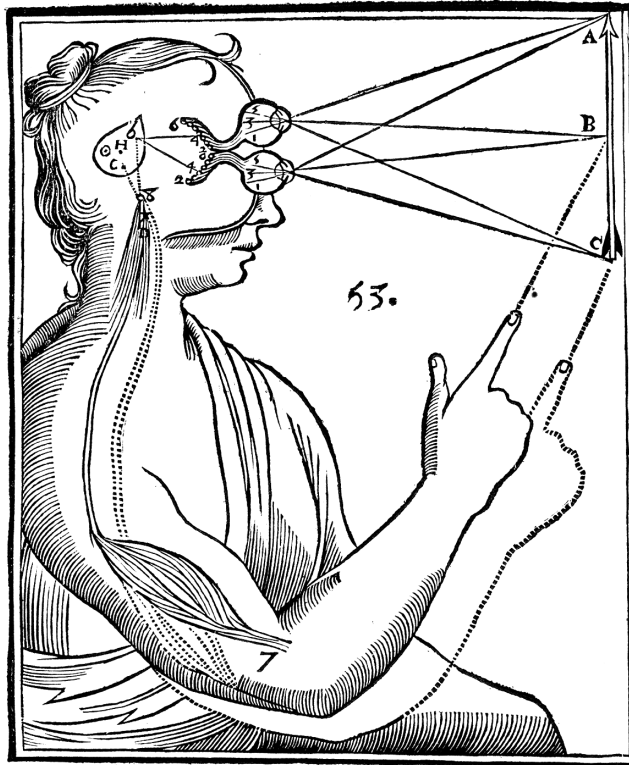


Figure 1. Pineal gland and flow of animal spirits in a mindless machine. Depending on the flow into tube 8, the arm points at B or C (*Treatise on Man*, 1667).

a and *b* have frequently co-occurred in sensory stimulation with *c* and *d*, sensory presence of *a* and *b* brings forth *c* and *d* in the brain (AT XI 177–79, G 150–52). Presumably, this accounts for the training of animals: “If you whipped a dog five or six times to the sound of a violin, it would begin to howl and run away as soon as it heard that music again” (AT I 134, CSMK 20); or training hunting dogs so that instead of running toward partridges they see and away from the sound of a gun, they halt at the sight of partridges and retrieve them once shot (AT XI 370, CSM I 378). Acquired alterations might explain how an animal can “learn” to return to where food has been found, or to avoid places where instinct has caused it to flee a predator.

The fourth factor, the character and force of the spirits, concerns bodily sensations such as hunger and the passions. Descartes sketched an ambitious program of mechanical explanation for human and nonhuman animals, including situationally appropriate behaviors. He attributes “passions” to mindless machines, by which he

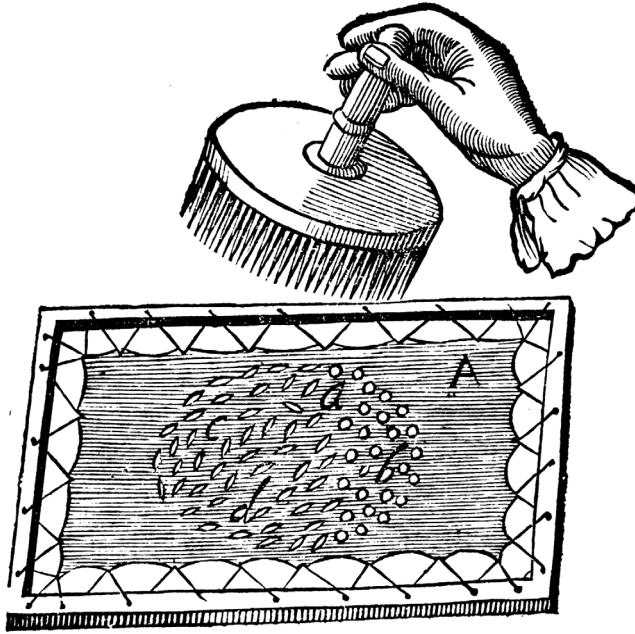


Figure 2. Analogy for associative memory in the brain. In a piece of cloth, patterns of pores that often open together may be such that if parts *a* and *b* are forced opened, *c* and *d* will also open (*Treatise on Man*, 1667).

means material processes like those that cause felt passions in human beings. Even in a human being, those brain processes that produce felt passions also cause the body, “without any contribution from the soul,” to respond in a way appropriate to the situation, such as fleeing danger (AT XI 358, CSM I 343).

The *Treatise* explains how material passions might work in a mindless human, and hence in animals:

Passions serve to dispose the heart, the liver, and all the other organs that determine the temperament of the blood – and consequently of spirits – in such a way that the spirits formed at a given time will be those suited for producing the external movements that follow. For suppose that the different qualities of these spirits are among the circumstances that affect their direction of flow (as I shall explain in a moment). In that case, one may easily believe that when it is a question of forcefully avoiding some evil by overcoming it or by driving it away – as the passion of *anger* inclines us to do – then the spirits must be more unevenly agitated and stronger than they usually are. Whereas, when it is necessary to avoid harm by hiding or by bearing that harm with

patience – as the passion of *fear* inclines us to do – then the spirits must be less abundant and weaker. (AT XI 193–94, Descartes 1972, 106, trans. modified)

The “passion of anger” mentioned here is the human mental passion, which inclines us to meet an evil head on. This passion is caused by brain processes that can also cause the body to turn to face the evil situation, without mental intervention. In animals, which possess only the brain processes, what we might call “physiological passions” guide their behavior.

Similarly, if a human or an animal has been without food, brain processes cause it to search for it. In a human, the same spirits that cause a sensation of hunger also cause the body to rove about until it finds food (AT XI 194–95; H 107). A similar flow of spirits causes animals, without sensation, to rove about until they find food, presumably detected by pattern matching in the brain due to instinct or to associative learning. Descartes is short on details, but his imagined mechanistic program is stunning in its claims to handle cognitive functions.

In describing the operations of mindless animals in the *Treatise*, Descartes used psychological terms, such as “senses,” “imagination,” “instinct,” and “memory.” He also imagined that brain mechanisms could make animals pursue benefits and avoid harms (AT XI 193, G 163). Do these facts indicate that, in the end, Descartes believed that animals are sentient and possess limited representational capacities? It seems not. Rather, Descartes is backing up his boast in the last paragraph of the *Treatise*, to explain how the offices of the sensitive soul can be mechanized (AT XI 202, G 169). He held to the view that among animals only humans have minds, and hence only humans feel and have the type of thought known as sense perception.

See also Anatomy and Physiology, Animal Spirits, Automaton, Common Sense, *Description of the Human Body*, Human Being, Imagination, Intellect, Machine, Memory, Mind, Passion, Perception, Reason, Sensation, Thought, *Treatise on Man*

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ANIMAL SPIRITS

The notion "animal spirits" derives from Hellenistic Greek medical theory. Physicians in the school of Alexandria circa 275 B.C.E. postulated a theory that, especially in the version of Claudius Galen (130–216 C.E.), endured into the eighteenth century. Three systems of tubular vessels – the veins, the arteries, and the nerves – were understood as containing, respectively, blood, vital spirit (*pneuma zootikon*, absorbed from the atmosphere), and psychic spirit (*pneuma psychikon*). The last, known in Latin as *spiritus animalis*, was thought to be produced in the brain by filtration or distillation from vital spirit and then distributed throughout the body by the nerves (Smith et al. 2012).

The notion of spirits played a role in Descartes' **philosophy** and science from the earliest stages of his investigations into living **bodies** (ca. 1630–32; see AT XI 505–38). In a 1643 letter, he in fact discusses three kinds of spirits: natural,



Figure 3. Animal spirits (*Treatise on Man*, 1667).

vital, and animal, differentiated by size and activity (AT III 685–89). But only the animal spirits played a central, psychophysiological role for Descartes. In the *Treatise on Man* (unpublished, ca. 1633), he explained that animal spirits are gradually filtered from the blood as it leaves the **heart**. The finest, most subtle and active particles ascend to the brain, in particular to its central chamber (the concavities or ventricles, where the **pineal gland** is located). From there the spirits can flow into the pores of the brain and into the nerves. He conceives of the nerves as tubes with fibers running down their center and filled with animal spirits. In his famous account of a **human being** whose naked foot is close to a fire (AT XI 141–42, CSM I 101–2), the heat sets off a **motion** in the central fibers that is conducted to the periphery of the brain chamber, where the nerve tubes have their orifices; that motion sets a pressure or flow through the ventricular spirits that move the pineal gland; in response, the gland produces counter-motions that **cause** other tube orifices to open or close and thus to admit more or less spirits; this differential motion of spirits is conveyed to the appropriate muscles, which lead to visible motions of the **animal** (such as moving the foot away from the fire) (Figure 3).

Descartes mentions this functioning only in the fifth part of the *Discourse* (1637) and recapitulates it in the *Passions of the Soul* (1649). Yet the latter work further develops the psychophysiology of the animal spirits by arguing that in dreams and imaginings the spirits alone can produce appearances like those that the central fibers do in sense **perception**, and that they also produce and reinforce **sensations** “of joy, anger and the like” (AT XI 347, CSM I 337) – the **passions** of the soul in the proper sense of the term.

Descartes’ animal spirits had a brief vogue among his followers in **medicine**. But compound microscopes, almost unknown before the 1660s, showed that nerves are not hollow. Anatomists and physiologists quickly abandoned spirits in favor of other kinds of mechanical **explanation**.

See also Anatomy and Physiology, Animal, Heart, Medicine, Memory, Native Intelligence, Perception, Pineal Gland, Passion, Sensation

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DENNIS L. SEPPER

AQUINAS, THOMAS (CA. 1225–1274)

As one of the leading intellectual figures of the Middle Ages, Aquinas was a Dominican master in theology who taught at the University of Paris (1256–59 and 1268–72), as well as in Dominican schools of Rome (1265–68) and Naples (1272–74). Following the impetus of his master Albert the Great (1206–80), he is responsible for having integrated into Christian thought philosophical themes found in Aristotle’s *Nicomachean Ethics*, *Metaphysics*, *On the Soul*, and *Physics*, which were made available for the first time in Latin translations in the thirteenth century. Aquinas’s grand synthesis of Aristotelianism and Christianity was extremely influential, so much so that Descartes had to be especially careful, four centuries later, not to offend the church when trying to replace Aristotelianism with his own philosophical ideas.

The influence of the *Summa Theologica* (1268–73), Aquinas’s *magnum opus*, was felt up through the seventeenth century. Along with Aristotle’s thought, Aquinas’s

work undergirded the educational system of the **Jesuit** schools in this period. Even at the threshold of the modern age, his work was the object of voluminous Jesuit commentaries, including those by **Francisco Suárez**.

Descartes rarely invokes the name of Aquinas in his writings, although he indicates in his correspondence (AT II 630, CSMK 142) that he possesses a “Summa” (presumably the *Summa Theologica*). And when the official objectors to the *Meditations* compelled him to compare his arguments with those of the Angelic Doctor, Descartes seems anxious to avoid direct criticism (as in the First Replies). But in developing his own doctrine he never ceases to struggle with Aristotelian themes, as reworked and elaborated by Aquinas. Three areas of particular concern are **knowledge**, **metaphysics**, and **physics**. With respect to the first, Descartes gives the theory of knowledge a primacy not found in either Aristotle or Aquinas. He also seeks to undermine the Thomistic empiricist dictum that “nothing is in the **intellect** unless it was first in the senses” (*nihil est in intellectu nisi prius fuerit in sensu*) and to develop a system of true knowledge obtained by withdrawing the **mind** from the senses (AT VII 9, CSM II 8). In metaphysics, the battle is fought over the concepts of **substance** and accident. Descartes rejects hylomorphism and criticizes the concepts of “**substantial form**” and “**real quality**”: according to him, mind and **body** are “really distinct” substances and their **essences** have nothing in common. Even though they are united, they do not constitute a single substance (though this is controversial; see **human being**). The concept of substantial form, that is, of an immaterial principle informing matter and constituting a substance, is thus rejected. Descartes also discards the notion of an Aristotelian accident, which is purportedly tacked on to substance, and replaces it with the notion of a **mode**, which can be understood only in terms of the essence of the substance that it qualifies. In so doing, he excludes the possibility of real qualities (or real accidents), which Scholastics like Aquinas treat as determinations of substance that cannot be conceived through the essence of that substance (AT III 420, CSMK 188; AT VIIIA 29–30, CSM I 214) (see **quality**, **real**). From the point of view of Descartes’ physics, the **explanation** of physical phenomena must be based exclusively on **extension** and its modes (especially **motion**) and can involve neither form (e.g., the form of fire) nor quality (e.g., heat) (AT XI 7–8; AT VI 239; AT VIIIA 52–53, CSM I 232).

Prompted by an objection by **Arnauld**, Descartes extends the battle with Aquinas to the field of theology. Arnauld claims that **Cartesianism** violates the church’s teachings on the sacrament of the Eucharist, which seems to require the notion of a real accident (AT VII 217, CSM II 153), since the accidents of the bread remain when the substance of the bread is removed (see **transubstantiation**). But as Descartes notes, the Council of Trent says that only the “species” of bread and wine remain, that is, their appearances (AT VII 251, CSM II 175). Aquinas held that the Eucharist must be explained on the basis of the permanence

of accidents, which purportedly can continue to exist without a subject (*Summa Theologica* IIIa q.77, a1, resp.). Although Descartes refrains from naming him, he takes this opportunity to deepen his rejection of real qualities: to admit them into one's metaphysics is contradictory, since to conceive of them as independent of the substances that they qualify is in effect to conceive of them as substances (AT VII 253–54, AT VII 434–35). He proposes that in transubstantiation only the surface of the bread remains and affects our senses and that alone accounts for the consistency of the appearance of the bread before and after the sacrament. In offering this account, Descartes appeals ironically to the authority of Aristotle (AT VII 249, CSM II 173–74; AT VII 434, CSM II 292).

Not all commentators agree that Descartes rejects Aquinas's philosophy wholesale. For example, Paul Hoffman has argued that, while Descartes rejects hylomorphism for the nonhuman universe, he retains it in the case of the human being (see **angel** and **human being**). Following Aquinas, he holds that the soul is the substantial form of the body and that the resulting mind-body union constitutes a third substance or genuine unity (i.e., *ens per se*) (2009, chs. 1, 2, and 5; cf. Carriero 2009).

See also Angel; Form, Substantial; Human Being; Mode; Quality, Real; Sensation; Substance; Transubstantiation

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ARNAULD, ANTOINE (1612–1694)

Born in Paris, Antoine Arnauld was often called “the Great Arnauld,” both to distinguish him from his father and because of his considerable intellectual abilities. He was a leader of the Port Royal circle and an eminent representative of classical Augustinianism. His extensive body of work covers primarily theological questions debated in connection with the controversies surrounding Jansen’s *Augustinus*. But he did devote some of his intellectual activity to **philosophy**, for the most part focusing quite closely on the thought of René Descartes.

Aside from his two co-written books (the *Grammar*, 1660, with Claude Lancelot; and the *Logic*, also called *The Port Royal Logic*, 1662, with Pierre Nicole) and the *New Elements of Geometry* (1667), Arnauld’s strictly philosophical work is concentrated at the start and close of his career. At the beginning, in 1641, he wrote a set of philosophical theses and, more importantly, the Fourth Objections to Descartes’ *Meditations*, followed by an exchange of letters with Descartes in 1648. But it is at the other end of his intellectual journey, in his last few years, that Arnauld wrote the bulk of his philosophical texts. Best known among his works from that period are his correspondence with **Leibniz** about the *Discourse on Metaphysics* (beginning in 1686) and the voluminous books written between 1683 and 1694 during his controversy with **Malebranche**. To these well-known works should be added a series of texts on **truth**, **ideas**, and human freedom written between 1680 and 1690.

The Fourth Objections were, for the young Arnauld, a sort of philosophical initiation, since Descartes himself let it be known that he considered them “the best of all [those that had been raised] because he [Arnauld] penetrated further than any of the others in what [he] had written” (AT III 331, CSMK 175). This set of objections shows Arnauld’s keen interest in Descartes’ philosophy, an interest that never faded, even if the degree of Arnauld’s adherence to Cartesian thought has been and continues to be debated.

The objections present two kinds of remarks. Remarks of the first kind address philosophical questions: Arnauld points out the Augustinian roots of the *cogito*, and then he brings to light some difficulties connected with the real **distinction** between **mind** and **body**, with the doctrine of a “materially false” idea (see **falsity**, **material**), with the conception of **God** as *a se* or *causa sui* (see **cause**), and finally with the famous objection that has come to be known as the **Cartesian Circle**. Remarks of the second kind cover “things that might be a stumbling block for theologians”: the generalized use of **doubt** and the compatibility between the Cartesian view of matter and the Catholic Church’s Eucharistic dogmas.

Together with **Clauberg**’s, Arnauld’s treatise on logic (*Logic or the Art of Thinking*, coauthored with Pierre Nicole) ranks among the most important Cartesian discussions

on the subject. It contains valuable reflections on the operations of the **mind**, as well as on the theory of signs or **language**. It has always been an object of great interest among commentators, especially in the 1960s and 1970s as a result of Noam Chomsky's *Cartesian Linguistics* (1966) and Michel Foucault's *The Order of Things* (1966).

Arnauld's writings against Malebranche cover two wide areas. The first includes questions in the philosophy of **knowledge**: against Malebranche's representational theory of vision in **God**, which makes the idea a *tertium quid* between the knowing mind and the known object, Arnauld defends Descartes' ontology of ideas (presented in the Third Meditation), making ideas simple **modes** of the mind. A lively tradition beginning with Thomas Reid (e.g., *Essay on the Intellectual Power of Man* II, 13) has found in Arnauld's texts arguments to defend "direct realism" in the philosophy of knowledge (see, e.g., the introduction to John Laird's *A Study in Realism* [1920], and Nadler 1989). The second theme in Arnauld's polemic is natural theology (proofs for the **existence** of God, the modes of God's acting in the world, the possibility of miracles, and theodicies of evil) and revealed theology (the distribution of grace and its efficacy).

In Arnauld's corpus, references to Descartes or Cartesian themes (like proofs for the existence of God and the real distinction between mind and body as an argument for the **immortality of the soul**) are so numerous, so integrated into his own thought, and so uniformly favorable (with the exception of letter 243 to Du Vaucel [?], October 18, 1669, where Arnauld refers to Descartes' "**Pelagianism**") that it does not seem far-fetched to call his philosophy, if not **Cartesianism**, at least strongly Cartesian inspired. (Indeed, Arnauld is the presumed author of the 1671 text: *Several Reasons to Resist the Censure and Condemnation of Cartesian Philosophy*.) But it is more difficult to decide whether Arnauld merely uses Cartesian philosophy as a critical and apologetic tool to attack theses he rejects (among atheists and libertines and in the thought of Malebranche and Leibniz), or whether there is a genuine "philosophy of Antoine Arnauld." This would be a "continued" Cartesianism, an application of principles and concepts fundamental to Cartesian epistemology (an idea being understood as a modification of the mind; God as "incomprehensible" while nonetheless being known clearly and distinctly; his criteriology of evidence) to topics Descartes barely discussed (e.g., the status of signs and, more broadly, "logic" and language, teleology, history, and providence). Recently, the degree of Arnauld's adherence to Cartesianism has been the subject of a debate among commentators (viz., Denis Moreau, Emmanuel Faye, Steven Nadler) who disagree as to whether he accepted the doctrine of "the creation of the **eternal truths**," a question that Arnauld himself raised with Descartes in letters from 1648.

In any case, lovers of Descartes will find much to study and learn in the "great Arnauld," who, Leibniz explained, "excels equally in theology and philosophy, in reading and in meditation" (Letter to Landgrave Hesse Rheinfels, February 11, 1686; Arnauld and Leibniz 1967).

See also Augustine, Aurelius; Cartesianism; Circle, Cartesian; *Cogito Ergo Sum*; Doubt; Eternal Truth; Falsity, Material; God; Idea; Jansenism; Language; Leibniz, Gottfried Wilhelm; Malebranche, Nicolas; *Objections and Replies*; Pelagianism; Representation; Transubstantiation

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DENIS MOREAU

ASTELL, MARY (1666–1731)

Born in Newcastle, England, Astell wrote four philosophical texts and several pamphlets to develop a systematic **metaphysics**, epistemology, ethics, political theory, and theology in order to address the condition of women. In doing so, she appropriates and

develops Descartes' ideas, which reveal the positive role his views play in the history of feminism (Atherton 1993). For example, she extends the Cartesian **method** such that all women and laboring men (who, unlike learned men, lack teachers and the experience of travel) can question custom and thus can prepare to engage in the skeptical concerns of the First Meditation and, ultimately, remedy the **passions** by acquiring generosity (see **virtue**) (Sowaal 2007).

God plays a central role in Astell's metaphysics, and she presents **ontological** and **cosmological arguments** for the **existence** of God. Unlike Descartes, however, she holds that God exercises his will in accordance with the nature and **truth** of things, and so is an "intellectualist," not a "voluntarist" (see **eternal truth**) (Broad 2002, 103). Her **dualism** involves the claim that **mind** and **body** are really distinct; she argues against **Locke's** treatment of thinking matter (Squadrito 1997, Taylor 2001).

Astell holds Cartesian views on **reason** (Atherton 1993) and employs his notion of clear and distinct **perception**, as well as his view that the **idea** of God serves as the basis for other ideas. However, she holds we cannot have distinct perceptions of God, our own souls, or bodies because the required intellectual exclusion is possible (*Serious Proposal*, 173) (see **abstraction versus exclusion**). Thus she is aligned with **Nicolas Malebranche** and John Norris (whose views of occasionalism and "seeing all things in God" she employs and critiques to various extents) (see **cause**). On Astell's occasionalism, see Wilson 2004, Taylor and New 2005, and O'Neill 2007.

Highly critical of the custom of marriage, Astell holds that many married women have become "slaves" to men and that there is a state of nature in the domestic sphere that has not been explored by the social contract theories of **Hobbes** and Locke. However, she does not advocate for divorce. Rather, she maintains that women should be better educated to fully understand vows before they make them and that society should offer an alternative to marriage (Weiss 2004).

Astell develops her theology by connecting biblical claims with philosophical ones. She also challenges priestly authority and traditional readings (e.g., of the doctrine of the Fall) and reveals ways in which biblical translations rest on philosophical interpretations (Thickstun 1992). In addition, she argues against Locke's views in *Reasonableness of Christianity* and Damaris Masham's in *Discourse concerning the Love of God*.

See also Cause; Dualism; Eternal Truth; God; Locke, John; Method; Passion

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ALICE SOWAAL

ATOM

Descartes ardently opposed atomism. His natural **philosophy** was appealing in part because it offered a well-worked-out plenist alternative (see **plenum**) to the atomist philosophies that were in vogue in his day – one that could take advantage of the

atomists' style of **explanation** of phenomena in terms of the size, **shape**, and **motions** of microcorpuscles, but without the need for the atomists' dangerous **metaphysics**, which rendered an immaterial **God** and soul superfluous. Nevertheless, there are certain aspects of Descartes' views that have led readers to suspect that his opposition to atomism was not as absolute as his words suggested.

In his *Principles of Philosophy* (1644), Descartes explicitly rejects the two founding assumptions of atomism. First, he argues that it would be contradictory for there to be an absolute **vacuum** (AT VIIIA 50, CSM I 230–31); then he offers a demonstration of the impossibility of atoms, arguing that their **existence** would be contrary to the fact that matter is essentially divisible (see **divisibility**): “It is impossible that there should exist atoms, that is, pieces of matter that are by their very nature indivisible, as some philosophers have imagined. For ... no matter how small we imagined them to be, they would necessarily have to be extended, and hence we could ... recognize their divisibility” (AT VIIIA 51, CSM I 231). The fact that matter is necessarily extended precludes the kind of point atoms entertained by the Zenonists, whereas the divisibility of **extension** precludes something being both indivisible and extended, as were the atoms proposed by Descartes' contemporaries **Sebastian Basso**, Daniel Sennert, Jean-Chrysostôme Magnen, and **Pierre Gassendi**. Descartes adds that even if **God** had made some particles “indivisible by any of his creatures,” he himself would still be able to divide them – a weak argument, to which **Leibniz** (2001, 25) responded, “This Gassendi would not have denied.”

Much more influential are Descartes' arguments for the possibility of motion in a plenum. Against the atomists' argument that a motion could not begin unless there were a void space for a **body** to move into, Descartes argues in the *Principles* that this objection is evaded if a ring of matter begins moving simultaneously; and against the objection that voids or condensations would be created by circulation of matter through unequal spaces, he argues that continuity can be preserved if the flow of matter through a space is swifter in inverse proportion to the width (i.e., cross-sectional area) of the space (AT VIIIA 58–59, CSM I 237–39). In order for this to happen, however, some parts of this circulating matter will have to adjust their **shape**, which they can do only by having their innumerable constituent particles slightly shifted relative to one another, resulting in an actually infinite or indefinite division of that part of the fluid matter (AT VIIIA 59–60, CSM I 239).

This assertion of the actual infinite division of parts of matter left Descartes open to the charge that he was composing the continuum out of material points. To such criticisms he responded (AT I 422, CSMK 65) that the particles of the **subtle matter** are continuous bodies, divisible to infinity, and that one “must not imagine that they are atoms, or at all hard” (AT I 140, CSMK 21). Nevertheless, **Cordemoy**, and also Leibniz, would later argue that in the absence of some principles of unity in matter, or substantial atoms, there is no justification on Cartesian

principles for bodies not to simply dissolve into points (see **individuation**). Again, some of Descartes' contemporaries identified him as an atomist because he used the same style of explanation as Democritus; to this he replied that the consideration of shapes, sizes, and motions was "adopted even by Aristotle and all the other philosophers" (AT VIIIa 325, CSM I 287).

Descartes did in fact appeal to atoms in his earliest investigations in natural philosophy, conducted under the influence of the atomist **Isaac Beeckman**, who initiated him into the microcorpuscular explanations characteristic of his philosophy and provided him with the foundation for his understanding of the laws of motion (see **inertia**). These atomist origins of Descartes' natural philosophy perhaps explain some of the tensions in his views. For example, it would seem impossible for bodies ever actually to exhibit the continued motion in a straight line that his first and second laws require (see **law of nature**). In order to allow for it, Cartesian subtle matter has to become so like the void as to be virtually indistinguishable from it.

Descartes has also been seen as advocating a form of temporal atomism in his proof of the **existence of God** (see **cosmological argument**) from the nature of duration in the Third Meditation (AT VII 49, CSM II 33) and *Principles* I.23 (AT VIIIa 13, CSM I 200). This claim depends on identifying the mutually independent parts of the duration of a created thing with the individual moments at each of which God conserves the thing, thus seemingly entailing the composition of duration from indivisible moments (see **time**). This tension between individual moments and continuous creation may, however, be another symptom of the atomist origins of Descartes' thought, where, in his solution to the problem of the falling body, he follows Beeckman in dividing its duration into atomic moments, only to take the limit to arrive at durationless instants and a continuous motion.

See also Basso, Sebastian; Beeckman, Isaac; Body; Cordemoy, Géraud de; Divisibility; Element; Extension; Individuation; Leibniz, Gottfried Wilhelm; Motion; Plenum; Shape; Subtle Matter; Time; Vacuum

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RICHARD T. W. ARTHUR

ATTRIBUTE

For Descartes, thinking is an attribute of **mind**, **extension** is an attribute of **body**, and **God's** attributes include absolute infinitude, necessary **existence**, immutability, eternity, omniscience, omnipotence, and benevolence. However, simply listing the attributes of Cartesian **substances** cannot do justice to Descartes' theory, which is complex and requires one to grasp the complementary notions of substance and **mode**. The precise meaning of "attributes" is also in need of careful scrutiny. Descartes sometimes speaks of attributes as modes (and vice versa), while in other places he draws additional, finer distinctions between attributes as kinds of modes, namely as modes of **thought** (i.e., as ways of thinking about a substance). Overall, the payoff of drawing these delineations is rich, as Descartes' account of attributes plays a central role in his rationalism, **metaphysics**, and epistemology; such distinctions are also useful in resolving purported problems with his **philosophy**.

Descartes distinguishes attributes from modes (both are kinds of affection) and substances (things) (AT VIIIA 22, CSM I 208). Substances are independent: God is the *primary* substance because he alone is absolutely independent; mind and body are *secondary* substances because they depend on God, but are independent of each other. All affections depend on God or on things that depend on God (AT VIIIA 22–24, CSM I 208–10).

Though Descartes sometimes collapses the distinction between attributes and modes (AT VIIIA 26, CSM I 211; AT VIIIA 30, CSM I 215; AT IV 349, CSMK 280), the passage in *Principles* where he assigns the terms "attribute" and "mode" specific meaning are particularly important. Here Descartes holds that whereas the word "mode" is used when we think of a substance as *modified*, "attribute" is used when we think of a substance as *general*, that is, as unmodified (unchanging). Given this, Descartes writes that God has attributes but no modes because it is unintelligible to regard God as modified (AT VIIIA 26, CSM I 211).

Descartes lists the divine attributes at various places in his work (see, e.g., AT VII 45, 50, 68–69, CSM I 31, 34, 47–48; AT VIIIA 26, CSM I 211) but privileges simplicity: “The unity, the simplicity, or the inseparability of all the attributes of God is one of the most important of the perfections which I understand him to have” (AT VII 50, CSM II 34; cf. AT VII 137, CSM II 98). Descartes also holds that God is indivisible, which he understands to mean both that God is immaterial and must be known all at once and in his entirety (AT VIIIA 13–14, CSM I 200; AT VII 371, CSM II 255–56).

In contrast to God, secondary substances can be regarded as both changing and unchanging, and thus there are both attributes and modes of mental and corporeal things. The attributes peculiar to created minds are **perception**, volition, and indivisibility (AT VIIIA 22–23, CSM I 208; AT VII 86, CSM II 59), whereas modes of minds are individual thoughts (AT VIIIA 31, CSM I 215).

Descartes often provides long lists of the affections of body, sometimes calling them attributes, sometimes modes. This is not contradictory, for an affection can be clearly and distinctly perceived both as an attribute and as a mode, albeit in different manners (AT VIIIA 30–31, CSM I 215–16). In light of this, we should understand his discussions of **shape** as both (1) an attribute that is rationally distinct from a corporeal substance (AT III 475, CSMK 202) and (2) a mode that is modally distinct from a corporeal substance (AT VIIIA 29–30, CSM I 213–14) (see **distinction [real, modal, and rational]**). Of course, given that extension as a whole – that is, the whole extended universe (*res extensa*) – does not have a boundary that demarcates its limit, it does not have a shape (AT VIIIA 15, CSM I 202). Rather, it has other attributes – including unbounded extension, divisibility, mobility, quantity of **motion**, and indeterminate infinity (AT IIIA 23, CSM I 208–9) – and so must be a created substance in a different sense than individual bodies. This is one reason for holding that the whole extended universe and individual bodies must be corporeal “substances” in different senses of the term – namely, secondary and tertiary substances (see Sowaal 2004, 2005).

In addition to attributes peculiar to each created substance, there are other attributes “common” to created minds and bodies: duration, **essence**, existence, finitude, dependence on God, independence of each other (AT VIIIA 24–26, CSM I 210–11). Each is an attribute of every mental substance and every corporeal substance. But one must not be misled by the term “common”; Descartes does not mean to suggest that attributes are literally shared. For example, the existence of a mind and the existence of each body are really distinct from each other. In this sense, existence is a “generic” attribute, as are the other common attributes (see **universal**).

Descartes holds that in addition to these “common” attributes, there is one attribute that is “principal” to each secondary substance (AT VIIIA 25, CSM I 210–11). The category of *principal* attributes is epistemic in two regards. First, an

attribute is “principal” in that it bears a specific relation to how *perceivers* come to know a substance: though we can know a substance through any attribute at all, we cannot know what is distinctive about a substance through the generic attributes. Second, principal attributes of a substance are those through which perceivers conceive all of its modes. These principal attributes constitute the nature and essence of the substance. Thought is the principal attribute of mind; extension is the principal attribute of body. Descartes does not make specific reference to God as having a principal attribute since he lacks modes (see Curley 1978, 128–30, 168).

Descartes draws a further distinction between attributes of things (viz., God, finite minds, and body) and attributes that are only in thought (viz., thoughts about God, finite minds, and body). He dubs the latter “modes of thought” (*modi cogitandi*), which are not to be confused with modes of finite minds (individual thoughts) (AT VIIIA 26–27, CSM I 212). Descartes uses the example of **duration** taken in the general sense and time (the measure of movement): temporal divisions (e.g., years, days) are attributes in thought (i.e., modes of thought) because they are ways of regarding duration, which is an attribute of things. Number, order, and all universals, too, are attributes in thought (i.e., they are ways of regarding other attributes), and not extramental entities, which exist separately in some Platonic realm (AT VIIIA 26–28, CSM I 211–13) (see Nolan 1998).

Descartes presents his account of substances, attributes, and modes in terms of his theory of distinctions – real, modal, and rational. The criteria for these distinctions involve two intellectual operations, exclusion and abstraction. When a meditator excludes, she attends to the **idea** of one being, A, and denies the idea of a second being, B, of it. When a meditator abstracts, she selectively attends to an idea of one being, A, in such a way that she ignores other ways of attending to the idea (see Gewirth 1998; Murdoch 1993; Nolan 1997, 1998; and Wells 1966) (see **abstraction versus exclusion**).

An especially important distinction in accounting for attributes is the rational distinction (Descartes calls it a “distinction of reason” [*distinction rationis*], and it is sometimes translated as “conceptual distinction”) (AT VIIIA 30–31, CSM I 214–15; AT III 475, CSMK 202–3). One might even say that Descartes defines attributes in terms of this distinction: an attribute, as opposed to a mode, is something that is merely rationally distinct from a substance. The criterion for a rational distinction involves an attempted two-way “exclusion” that fails (AT III 275, CSMK 202). A failed *one-way* exclusion results by way of an intellectual operation in the following manner: a perceiver loses a clear and distinct perception of one being, A, when she excludes from it the idea of another being, B. Failed *two-way* exclusion (sometimes called a failed “mutual” exclusion) happens when there is a failure in both directions. When there is failed mutual exclusion between ideas of A and B, then A and B are either a substance and an attribute of that substance or two attributes of a single substance. Some commentators have argued that a rational distinction is produced

in thought by a process of abstraction (Nolan 1997, 1998). For example, one attends to God's existence while ignoring (but *not excluding*) his immutability (or any other attribute).

There are several lines of interpretations of attributes. One view endorses the Identity Thesis: a substance *just is* each of its attributes; "they" are identical in reality. The diversity between a substance and its attributes, as well as among the attributes of one substance, is *merely apparent* and derived from different clear and distinct ways of regarding a substance. To avoid well-known problems, such claims of identity must be stated very carefully: for example, a mental substance is merely rationally distinct from *its* thinking or *its* duration (*not* from thought or duration in general) (Nolan 1997, 1998).

The Cognitive Route and the Attribution Theses extend the Identity Thesis (Sowaal 2011). According to the Cognitive Route Thesis, each different clear and distinct way of regarding a substance is a "cognitive route": a series of considerations that begins with confusion; involves mental operations such as abstraction, exclusion, and **deduction**; and ends with a clear and distinct perception of the substance (AT X 370, CSM I 15; AT X 387, CSM I 25; AT X 401, CSM I 33). At different times, a meditator may take different cognitive routes to a clear and distinct perception of a substance. For example, she may begin with a confused understanding of herself as having finite power and, through a series of considerations, end with a clear and distinct perception of God. At another time, she may begin with a confused understanding of herself as having finite **knowledge** and, through a series of considerations, end with a clear and distinct perception of God. Along these two different cognitive routes, there are opportunities for abstraction, exclusion, and deduction; at different points along the routes, the ideas involved differ phenomenologically from ideas that are earlier and later along the route, as well as from ideas on different routes. Though taken at different times, the two cognitive routes arrive at the same terminus: a clear and distinct perception of God, which has God as its objective reality.

According to the Attribution Thesis, perceivers assign attributes to substances as a result of regarding substances in different ways. Of course, a perceiver makes a correct attribution to a substance only when one of these ways of regarding a substance terminates in a clear and distinct perception of it. For example, consider the meditator in the example just given: she has taken two routes to the clear and distinct perception of God, one that focused on knowledge and one that focused on power. When she refers to her two (modally distinct but objectively identical) clear and distinct perceptions of God in terms of the routes that led her to them, she refers to that perception in two ways – as an idea of God's omniscience and as an idea of God's omnipotence. In doing so, she makes two different attributions to God. In this sense, omnipotence and omniscience are two attributes of God. Of course, "they" are identical with each other and with God; the apparent diversity between them is

the result of our different cognitive routes. Textual evidence for this consists in part in passages in the *Meditations* and *Replies* where Descartes writes that the meditator attributes to God his various attributes (AT VII 46–47, 49–50, 142, 188, 364, 428; CSM II 32, 34, 67, 101, 132, 251, 252, 289).

These three theses also allow us to account for Descartes' discussion of the "foundation in reality" of the rational distinction between a substance and its attributes for finite perceivers, thus further respecting texts about the simplicity of substances (AT IV 349–50, CSMK 280). Note that it is the perceiver's own finitude that leads her to take different routes in the first place: she may begin her cognitive routes by reflecting on how power and knowledge seem to exist separately in her; she may then suppose this same separation is in God, and for this reason she may engage separate cognitive routes in thinking about God. Further, it is in virtue of her finitude that she has a temporal display of thought (unlike God, who thinks all things at once) and that she comes to index this display with names that reflect points on the cognitive routes that are prior to the successful termini. The perceiver's finitude is the "something" that grounds the distinction as one *ratiocinatae*, rather than as rendering it as a distinction made by reason *ratiocinantis* (which is grounded in "nothing"). For uses of "cognitive route" in the literature, see Nolan 1998 and 2005, Nelson 2008 and 2013, Rogers and Nelson forthcoming. For a detailed development of the Cognitive Route Thesis and Attribution Thesis, see Sowaal 2011.

According to a third line of interpretation, put forward by Bracken (1964) and developed by Lennon (1993, 115–16), there is a deductive relation between a substance and its attributes and modes: just as geometrical theorems are deduced from geometrical axioms and postulates, so attributes are deduced from the concepts of substances. This reading rests on Descartes' account of the modal distinction. The Deductive Connection Thesis seeks to respect the simplicity of substances. However, insofar as it holds that substances stand to their attributes as do geometrical axioms and postulates stand to theorems that are derived from them, it supposes a logical relation between a substance and its attributes, and thus an inner structure to a substance. This is clearly problematic in the case of God, for Descartes maintains that no variation in God is intelligible (AT VIIIA 26, CSM I 211; AT VI 35, CSM I 128–29; AT VIIIA 13, CSM I 201).

A fourth line of interpretation holds that attributes "inhere" in a substratum-like substance from which they are "inseparable" (Curley 1986, 166; Wilson 1978, 77, 83; Hoffman 2002, 61). The primary textual support for the Inherence Thesis is from the **Geometrical Exposition**: "This term ['substance'] applies to every thing in which whatever we perceive immediately resides, as in a substance, or to every thing by means of which whatever we perceive exists" (AT VII 161, CSM II 114). There is some evidence that Hume and Kant also interpreted Descartes in this manner (Nelson 2005a, 403). However, the Inherence Thesis is in tension with some

other passages. One is *Comments on a Certain Broadsheet*, in which Descartes distinguishes his views from those of **Regius** by noting: “I did not say that these attributes are present in the substances as in subjects distinct from them” (AT VIIIB 348, CSM I, 297). Another is Descartes’ replies to **Gassendi**, in which Descartes presents the view that God is simple (and thus without composition) (AT VII 371, CSM II 255–56).

Commentators who appeal to the Identity Thesis and Cognitive Route Thesis take seriously a reading of Descartes as grappling with the problematic of a “rationalist metaphysics.” On this view, reason is not only the mode of access to the truth but also the vehicle that employs the rational distinction to draw from that simple source the diversity that characterizes phenomena and thus the richness of human experience (see Lennon 2005, Nelson 2005a and 2005b for an account of how this is a traditionally rationalist approach). The resulting metaphysical issues involve the mereological ones of simplicity and variety. It is within the frame of this rationalist metaphysics that Descartes’ views on attributes and the rational distinction are seen as deeply tied with his account of how *appearances* of all forms of diversity (e.g., time, space, change, individuation) are rooted in his ontological parsimony.

See also Abstraction versus Exclusion, Deduction, Distinction (Real, Modal, and Rational), Essence, Mode, Substance, Universal

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ALICE SOWAAL

AUGUSTINE, AURELIUS (354–430)

Born in Thagaste, North Africa, on November 13, 354, Augustine studied rhetoric at the University of Carthage and taught rhetoric, both in North Africa and later in Italy. As a young adult he was a Manichaean "hearer," but he became disillusioned with Manichaeism. At twenty-nine he sailed for Italy, where he lived for about five years. In Milan he was given a Christian baptism by Bishop Ambrose. After the death of his mother, Monica, he returned to North Africa, where he spent the rest of his life and became bishop of Hippo Regius. His treatises, biblical commentaries, sermons, and letters constitute the largest body of writing we have from any ancient author.

In the Fourth Objections, **Arnauld** identifies Augustine's *De libero arbitrio* 2.3 as a source for Descartes' *cogito* (AT VII 197–98, CSM II 139). Later in his

Objections Arnauld offers support from two of Augustine's works for Descartes' claims about the **certainty** of **reason**. Still later, Arnauld recommends Augustinian support for the claim of **God's** "eternally present **existence**" (AT VII 211, CSM II 148). Finally, Arnauld offers a warning from Augustine that "absolutely nothing in human society will be safe if we decide to believe only what we can regard as having been clearly perceived" (AT VII 217, CSM II 152). Descartes, in his reply to Arnauld, thanks him for "bringing in the authority of St Augustine to support me" (AT VII 219, CSM II 154) but acknowledges no debt to Augustine or any need to respond to his views. However, Descartes does thank **Colvius**, in a letter, for calling his attention to a passage in Augustine relevant to the *cogito*. He adds that he went to the town library to check it out, as if it were new to him (AT III 247, CSMK 159). However, recent scholarship (see especially Menn 1998) reveals the extensive debt Descartes owes to Augustine. Certainly something very close to Descartes' *cogito* is to be found in Augustine's *City of God* 11.26 and in his *De trinitate* 15.12.21, as well as in the *De libero arbitrio* passage Arnauld mentions. But there are other important similarities as well. Thus, Descartes characterizes a *res cogitans* as "a thing that doubts, understands, affirms, denies, is willing, is unwilling, and also imagines and has sensory perceptions" (AT VII 28, CSM II 19). For Augustine, a **mind** (*mens*) is something that "lives, remembers, understands, wills, thinks, knows, and judges" (*De trinitate* 10.10.14). Finally, Menn (1998, ch. 7) has made a plausible case for concluding that the structure of Augustine's attempt in his *De libero arbitrio* to solve the problem of evil is mirrored in Descartes' attempt to reconcile the "cognitive evil" of human error with the goodness and power of God.

See also Arnauld, Antoine; *Cogito Ergo Sum*; Error, Theodicies of; God

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GARETH MATTHEWS

AUTOMATON

The words *automaton* and *automate* occur infrequently in Descartes' works. But the occasions on which they occur are noteworthy. In the concluding paragraph of the *Treatise on Man*, he says that the functions of **animals** follow from the disposition of their organs, like those of a "clock, or other automaton" (AT XI 202, CSM I 108). In the *Meditations*, the meditator wonders whether beneath the cloaks and gowns he sees outside his window there are humans or automata (AT VII 32, CSM II 21). Most memorably, in the *Discourse* Descartes explains how an automaton with a soul may be distinguished from one without (AT VI 55–56, CSM I 139–40).

Automaton and **machine**, though allied, are distinct concepts. A Cartesian machine is a collection of **bodies** whose operations can be explained on mechanical principles alone: its parts are just parts of **extension**, and their motions are entirely subordinated to the **laws of nature**. (Human machines are built to serve human ends, including the "banausic" end of entertainment, sometimes by imitation; the machines of the *Treatise on Man* are said to be designed by God to imitate our figure and motions as do the figures and motions of the statues in the gardens of Saint-Germain, noted by Descartes in the *Treatise*.)

An *automaton*, on the other hand, is a self-mover, the proximate cause of certain of its own changes. The classical automata of antiquity were self-movers but not in every case machines. Aristotelians hold that **animals** are automata: self-movement distinguishes living things among natural things. For Descartes, the issue is not whether animals are self-movers, but how to accommodate that fact in a mechanistic physiology. He can be seen to have divided the problem into two: (1) the self-movement of the animal during its lifetime, which includes nutrition and growth as well as locomotion; (2) the special self-movement at the beginning of an individual's life, which consists in the *self-assembly* of its parts. Descartes addressed the first problem in the *Treatise on Man*; the second he considered at greatest length in the *Description of the Human Body*.

For Descartes, the self-movement of the animal during its lifetime amounts to self-*locomotion*. In the *Treatise on Man*, he took as his chief problem first of all the reduction of the functions of what the Aristotelians called the vegetative part of the soul (roughly what is now the subject matter of physiology) to the motions of Cartesian bodies – that is, to corpuscles characterized in terms only of their **shapes**, sizes, and typical **motions**. The source of an animal's motions is ultimately the boiling of blood in the **heart**; this causes the blood to circulate and refresh the other parts of the body. The heart functions as the *power source* of the body machine (on heat as the principle of motion in animals, see Bitbol-Hespériès 1990).

Descartes attempted to reduce, moreover, those functions that the Aristotelians had associated with the sensitive part of the soul to interactions between the **animal**

spirits, the nerves, the brain, and the muscles. So, for example, the movements of a sheep away from the wolf that the Aristotelian ascribes to fear Descartes determines to be effects of animal spirits, stirred by the senses, entering the muscles after having been directed to them by changes in the position and attitude of the **pineal gland**. The appearance of spontaneity in the movements of animals in response to external stimuli was thus also accounted for.

See also Anatomy and Physiology, Animal, Animal Spirits, *Description of the Human Body*, Heart, Machine, *Treatise on Man*

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DENNIS DES CHENE

BACON, FRANCIS (1561–1626)

Born in London, Bacon pursued a political career after legal education at Cambridge and Gray's Inn. He took a seat in Parliament in 1584 with ambitions for personal advancement and intellectual reform. Under James I, Bacon rose to lord chancellor but a bribery conviction ended his public service in 1621. He thereafter concentrated on his vision for a new system of learning. His major philosophical works are *The Advancement of Learning* (1605), the *Great Instauration* (including the *New Organon*) (1620), and the posthumous *New Atlantis* (1627). **Thomas Hobbes** (briefly Bacon's secretary) is the source of the famous story that Bacon died from an infection contracted during impromptu **experiments** in refrigeration.

An unfailing intellectual optimist and champion of innovation, Bacon derided the prevailing philosophies of science as conservative and authoritarian. He specifically criticized Aristotelian **Scholasticism** for its excessive abstraction, syllogistic **method**, and fixation with **causes** and Renaissance humanism for its bookishness, eclecticism, and Platonic **metaphysics**. At a more general level, Bacon maintained that scientific progress required emancipation from pervasive intellectual “idols” of the tribe (cognitive biases in human nature), of the cave (individual prejudices), of the marketplace (confounding of words and things), and of the theater (dogmatic adherence to authority).

As a metaphysical framework for natural **philosophy**, Bacon favored Greek atomism. On method, he advocated a thoroughgoing empiricism that begins with the meticulous collection and classification of directly observable facts. Laws or axioms are inductively generated from these experiments. Rather than “leap from sense and particulars to the most general axioms,” the disciplined philosopher “elicits axioms from sense and particulars rising in a gradual and unbroken ascent to arrive at last at the most general axioms” (2000b, 36). Bacon esteemed scientific **knowledge** not merely for its own sake but also for the “relief of man's estate” (2000a, 32) and was a proponent of natural religion: “Natural philosophy, after the word of God, is at once the strongest remedy for superstition and the most proven food for faith” (2000b, 75). The Royal Society was founded on Baconian principles.

While no inductivist, Descartes frequently echoed Bacon's call for careful observation in natural philosophy (e.g., AT VI 63, CSM I 143). The elevation of **enumeration** and synthesis over **sylogism** in the *Rules for the Direction of the Mind* and *Discourse on Method* suggests the influence of Bacon on Descartes' early theory of method. Indeed, Descartes occasionally mentions Bacon with approval (using his peerage title Verulam) during this period. Thus, in a 1632 letter he endorses “la methode de Verulamius” for astronomy: “Without putting forward any **explanations** or hypotheses, describe exactly the present appearances of the heavens” (AT I 251, CSMK 38; cf. AT I 109, 195–96).

See also Atom; Enumeration; Experiment; Hobbes, Thomas; Method; Syllogism

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GEOFFREY GORHAM

BAILLET, ADRIEN (1649–1706)

Baillet was born June 13, 1649, at La Neuville-en-Hez, a small town between Beauvais and Clermont (Oise), the eldest of seven children from a second marriage. His parents were of modest fortune. He was educated at the College and Grand Séminaire (1670) of Beauvais and ordained as a priest in 1676. After a few years as village priest he was offered a job as librarian of François-Chrétien de Lamoignon (1644–1709), a literary patron and collector of books. Baillet remained in Lamoignon's service until he died January 21, 1706. Although Baillet is now known mainly for his biography of Descartes (1691), he published not only learned compilations like *Jugements des savants sur les principaux auteurs* (1685) but also historical works such as *Histoire de Hollande* (1690) and books on piety and devotion, including *Dévotion à la Vierge* (Paris 1693) and *Vies des saints* (Paris 1701). These works came under criticism from the church, which placed them on the Index because it found Baillet's approach to hagiography too critical.

According to Baillet's biographer, it was his friend Abbé Jean Baptiste Le Grand who, "together with other interested parties" (possibly Lamoignon), asked Baillet's help in arranging the notes he had collected on Descartes. Baillet in turn introduced Le Grand to Abbé Claude Nicaise (1623–1701), an erudite with connections all over Europe (Baillet to Nicaise, April–May 1689, BNF fonds français 9361, 172–73). At that stage it was still Le Grand's project. Eventually they arrived at a division of labor: Le Grand would work on a new edition of the works and letters, the material

for which had been given him by **Clerselier**, whereas Baillet would concentrate on a biography. It took one year to write the biography – the new edition never materialized. An abridged version of the biography, which on some points provides a different story, was published two years later (1693). The documentary basis of Baillet's work was laid by Le Grand. Moreover, Baillet could build on earlier biographies like those of Borel and Lipstorp. Still, his role was not simply to organize existing data. He tried to obtain accurate information on Descartes' Dutch friends and enemies. He used letters that are no longer extant (e.g., those to and from **Regius**) and had access to the correspondence with **Mersenne** (which was dispersed during the nineteenth century). Even so, the book should be used with some caution. By the end of the seventeenth century, Descartes' reputation was not unchallenged, especially from a theological point of view. Accordingly, one of Baillet's main concerns is to depict Descartes as a pious Roman Catholic as well as a hero of irreproachable manners. Above all, his fundamental belief in the truth of Descartes' philosophy and the accuracy of his methods leads him to treat adversaries, like Regius, in an unjust manner. In a general way, though, Baillet's book is still the most important source for our knowledge of Descartes' life.

See also Clerselier, Claude; Mersenne, Marin; Regius, Henricus

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THEO VERBEEK

BALZAC, JEAN-LOUIS GUEZ DE (1595–1654)

This Balzac was also an important French writer, not of the nineteenth century, but of the seventeenth. He was, like Descartes, initially educated by the **Jesuits** and later

was at the university in Leiden. His literary reputation was based largely on his correspondence, which was twice collected and published during his lifetime. He was elected, in some capacity, to the French Academy (he was several times favored by appointments from Richelieu). His place in history was secured not by what he said (even his supporters loudly failed to describe him as a genius) but by how he said it (everyone acknowledged that he had contributed to the development of the modern French language).

He felt “the closest and most sincere friendship” after Descartes’ espousal of his cause in 1625 with the Papal Legate in France in dealing with the aspersions against him by the publication of correspondence by a priest named Goulu. The issue was Balzac’s perceived self-centeredness (his enemies called him “Narcissus”). According to the later author of the *cogito*, “it is sometimes necessary to speak of oneself with the same freedom that one does of others.” Not incidentally, Descartes’ judgment of Balzac, even if written in Latin, might be proleptically the most Proustian text in all of French literature (AT I 7–11). In any case, the text is important for understanding Descartes’ early thoughts on attention in clearly and distinctly perceiving the **truth** (see **clarity and distinctness**).

He “esteemed the heart of his friend more than his **mind**,” but Descartes nonetheless praised the purity of Balzac’s literary style, which he compared to the health of the **body**, “never more perfect than when it is least noticed.” When the *Discourse on Method* appeared, Descartes wrote to Balzac in the hope that his own lack of style in the work he was sending him might be overcome by Balzac’s affection for him and result in a favorable judgment of it.

Balzac expressed a strong desire to visit Descartes in Holland, indeed to take up residence with him there, but his proposal came to naught, perhaps because of **Villebressieu**, who had a different conception of how, and with whom, Descartes should spend his time.

See also Villebressieu, Étienne de

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THOMAS M. LENNON

BASSO, SEBASTIAN (SÉBASTIEN BASSON) (DATES UNKNOWN)

Basso the person remains an obscure figure to this day. He was most likely born between 1577 and 1583 in the Duchy of Lorraine, near Metz, but this is not certain, and the date and circumstances of his death remain unknown. We do know that he authored the *Philosophiae Naturalis Adversus Aristotelem*, an anti-Aristotelian textbook that aims to reinstate the **physics** of the ancients, first published in Geneva in 1621, and by Elzevier in 1649. Having become Calvinist, he completed it while teaching at a Huguenot academy in the French Alps, and remained in this position, which did not befit his qualifications as a physician and natural philosopher, until 1625 (see **Calvinism**). He was granted leave with pay after threatening to publish an atheist tract and subsequently disappeared from view as suddenly as he appeared (Lüthy 1997, 199, 24–29, 52).

Basso's treatise was recognized as an important, albeit flawed, work by Daniel Sennert and **Marin Mersenne**. **Galileo** owned a copy of the first edition, and **Isaac Beeckman** discusses it favorably in his journal. On October, 8, 1629, René Descartes writes to Mersenne: "As for **rarefaction**, I am in agreement with this physician and have now taken a position on all the foundations of **philosophy**; but perhaps I do not explain the ether as he does" (AT I 25). The physician in question, formerly thought to be Villiers, is Basso (AT I 665). Writing to Beeckman on October 17, 1630, Descartes lists Basso as one of the *novatores* who has nothing to teach him (AT I 158, CSMK 26–27).

Basso's **physics** is an amalgam of atomist, Neoplatonist, and Stoic principles. **God** creates microscopic **atoms** at the beginning of time (Basso 1621, 14). These simple, homogeneous **bodies**, each possessing a particular property, are indestructible, except by divine power (125–26). Their properties are inalienable and persist when an atom enters into a compound (73–74). There are four kinds of elementary atoms corresponding to the **elements** of fire, air, water, and earth. Basso adopts Plato's view that the elements have specific **shapes** without specifying these shapes, except for fire atoms, which all the ancients described as sharp and pointed (109). The four elements lack intrinsic motive forces; rather, all natural change is due to the local **motion** of atoms being pushed by the ether (387–88). The Stoic

ether, or common spirit, is a very tenuous corporeal **substance** that pervades the universe, entering in between the parts of matter to cause rarefaction. Basso links it to the divine **mind** that is intimate to all things (344–45) and the Neoplatonic World Soul or universal form of the *cosmos* (307). While Basso's physics represents an important shift away from Aristotelianism, it is a far cry from mechanism (see **mechanics**).

See also Atom; Beeckman, Isaac; Element; Physics; Rarefaction and Condensation

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HELEN HATTAB

BAYLE, FRANÇOIS (1622–1709)

Born at Boulogne (St. Bertrand), a village in the foothills of the Pyrenees, Bayle was well known throughout England, France, and Germany as an esteemed physician, inventor, and savant. He was author of some fourteen works spanning topics in **medicine**,

philosophy, physics, anatomy, and biology. He was a strong exponent of experimentation and **Cartesianism** and a member of the famous Société des Lanternistes.

During 1665–71, Bayle met and worked with **Pierre-Sylvain Régis**, a student of **Jacques Rohault**, who was sent from Paris to offer courses on Cartesianism. Bayle's *General Systeme of the Cartesian Philosophy* appeared in 1669 and contains the first complete statement of Descartes' system. It is adumbrated but complete; it includes topics ranging from **metaphysics** and logic to plants and **animals**. Of note, given Bayle's concern with the role of experience in science, is the inclusion of the three grades of sensory response from Descartes' Sixth Replies (AT VII 436–38, CSM II 291–95) (see **sensation**).

By 1670, Bayle habitually opened the Cartesian conferences, lecturing on curious medical cases, such as his study of a twenty-five-year pregnancy. He believed that such "freaks of nature" play an important role in the progress of science, piquing the curiosity of the scientist and motivating him to tedious study. With the publication of *Dissertationes medicae tres* in 1670, Bayle's work and merit were recognized by the Royal Society of London and the Académie des sciences in Paris.

Bayle's *Discourse on Experience and Reason* (Lennon and Easton 1992) carries the subtitle: "In which it is shown the necessity of joining the two in physics, in medicine, and in surgery." Bayle criticizes placing reason above experience and failing to draw on reason to identify **causes**. He praises Descartes' genius for identifying causes while cautioning the lack of sufficient observations for conclusions concerning the movement of the **heart** and the function of the **pineal gland**.

In addition to his activities as reformer, teacher, scientist, and physician, Bayle served as adviser to the Parlement of Toulouse in 1681 when summoned to examine multiple cases of alleged demonic possession. Against the common superstitions of the townspeople, Bayle offered a naturalistic **explanation**, which carried the day.

Much of his later writings concerned topics in physics, anatomy, and plants and **animals**, subjects treated in his most substantial work, the *Institutiones* (1700–1). He died on September 24, 1709, at his home in Toulouse, at the age of eighty-seven.

See also Cartesianism; Experiment; Explanation; Medicine; Régis, Pierre-Sylvain; Rohault, Jacques

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PATRICIA EASTON

BAYLE, PIERRE (1647–1706)

Born at Le Carla, Bayle studied **philosophy** at Puylaurens and Toulouse before teaching at the Protestant Academy of Sedan and finally at the École Illustre of Rotterdam. He is best known for his *Dictionnaire historique et critique* (1st ed., 1697; 2nd ed., 1702) and for several philosophical works: *Pensées diverses sur la comète* (1682) against superstition, *Commentaire philosophique* (1686–88) on religious toleration, and *Entretiens de Maxime et de Thémiste* (1707) on the problem of evil (to which **Leibniz** responded in his *Theodicy*). Bayle died in Rotterdam.

Cartesian themes run throughout Bayle's writings, but he devoted only three early works (ca. 1680) explicitly to elements of Descartes' philosophy: the *Dissertatio* (1964–, 4:109–32), in which the account of **body** in terms of *res extensa* is defended (see **extension**); the *Theses philosophicae* (1964–, 4:132–45) on twelve diverse topics; and the *Objectiones* (1964–, 4:146–62) to Pierre Poiret's 1675 *Cogitationes rationales*, in which Poiret grounded Christian theology on Cartesian **metaphysics**. In several articles of his *Nouvelles de la république des lettres* of 1684–87 (1964–, vol. 1), Bayle also engaged in the debate between the Cartesians **Malebranche** and **Arnauld**. It is notoriously difficult to discern Bayle's intentions in these or any of his works, such that it is now common to speak of the “Bayle enigma” (see Lennon 1999). Not surprisingly, then, the literature presents various approaches to understanding the general relationship between Bayle and **Cartesianism**.

Paganini (2008) argues as follows that Bayle's skeptical arguments contributed to the demise of Cartesian metaphysics. In remark B of the article “Rimini” in the *Dictionnaire*, Bayle commented on a discussion in the **Second Replies**. Descartes was informed that the fourteenth-century theologian Gregory of Rimini taught that **God** could deceive, if only to bring about a good effect. Bayle argued that Descartes' reply effectively conceded Rimini's thesis and concluded that Descartes' metaphysics, relying on absolute divine veracity, was thereby “ruined.” Moreover, in his discussions of the problem of evil (e.g., *Dictionnaire*, “Manichéens” and “Pauliciens”), Bayle sought to demonstrate the impossibility of theodicy, thereby undermining Descartes' Fourth Meditation (see **error**, **theodicies of**).

Others emphasize Bayle's debt to Descartes. Labrousse (1963–64) argued that the *Dictionnaire* represents Bayle's transposition of the Cartesian **method** of **doubt** from metaphysics to the domain of history. While the Cartesian metaphysician accepts only what is clearly and distinctly perceived, the Baylian historian accepts only what is contained in or derivable from documented evidence. Ryan (2009) provides specific examples of Bayle's debt to Descartes and Malebranche in metaphysics: the ontology of **substance**, the conception of matter as pure extension, **dualism**, and the Malebranchian distinction between **ideas** and sentiments. Against Bayle's self-description as an impartial reporter of debates, Ryan argues that these Cartesian theses represent strong commitments in Bayle's writings.

See also Calvinism; Cartesianism; Error, Theodicies of; Malebranche, Nicolas

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MICHAEL HICKSON

BEAUGRAND, JEAN DE (1595–1640)

Beaugrand was both a lawyer and a mathematician. Descartes had contempt for him, saying so in so many words (AT II 25, CSMK 89). Descartes' condemnation was strong, even by his own standards, referring to Beaugrand's appeal to living authorities in mathematical matters as testifying to his impudence and effrontery no less than his ignorance, and to his book on "geostatics" as so impertinent, ridiculous, and detestable as to cause wonder that anyone should have read it (those who

did so generally shared Descartes' view, if not his language in expressing it) (AT III 188–89). Indeed, in reaction to a letter of his that **Mersenne** conveyed after his death, Descartes urged that no more be sent because he already had enough toilet paper, which was the only use for Beaugrand's correspondence (AT III 437).

It is not irrelevant to these hard words that Beaugrand had accused Descartes of borrowing from Vieta, whose work Beaugrand had edited, and Harriot in his *Geometry*, which he had occasion to examine as secretary to the *chancelier* when Mersenne on Descartes' behalf submitted the *Discourse on Method* and accompanying "Essays" for the *privilege* to publish. Nor is it irrelevant that Beaugrand himself was soon accused of plagiarism. Accusations of this sort are multiply difficult to deal with, but perhaps the most relevant feature for contemporary readers of Descartes is the perception of them in the period. **Pascal's** account (unaltered in its basic features by **Baillet's** later version, which nonetheless differs in some respects) is that Beaugrand sent to **Galileo** unsigned copies of solutions to problems concerning the cycloid by **Roberval**, **Fermat**, and Descartes, and did so in such a way as to lead one to think that the solutions were his own. (The imbroglio, on this account, was extended when upon Galileo's death the material was passed to Torricelli.)

See also Baillet, Adrien; *Discourse on Method*; Fermat, Pierre de; Galilei, Galileo; Mersenne, Marin; Pascal, Blaise; Roberval, Gilles Personne de

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THOMAS M. LENNON

BEECKMAN, ISAAC (1588–1637)

Beeckman was born and raised in the city of Middelburg, capital of the Dutch province of Zeeland, where his father had established himself as a candlemaker. Owing to his father's difficulties with the Reformed Church in Middelburg, Isaac was sent to the Latin schools at nearby Arnemuiden and Veere, before entering Leiden University

in 1607 to study theology and **mathematics**. The well-known Ramist mathematician and philosopher Rudolph Snellius (father of Willebrord Snellius) was one of his teachers. Beeckman left Leiden in 1610 but was unable to find a place as a minister in the Reformed Church and ended up practicing his father's trade in the city of Zierikzee (he also repaired water conduits in breweries and fountains). By 1616, however, he handed over his shop to his assistant and took up the study of **medicine**. In September 1618 he traveled to Caen in Normandy, where he received a doctorate in medicine on a thesis on intermittent fevers. After his return to the Dutch Republic, he entered upon a career as a schoolmaster in the Latin schools of Utrecht (1619–20), Rotterdam (1620–27), and finally Dordrecht, where he was rector of the school (1627–37).

During these years, Beeckman kept a scientific diary, the so-called *Journal*, in which he noted his highly remarkable and original insights into the workings of nature. Only a few friends were allowed to consult his notebooks, among them Descartes, whom Beeckman had met in November 1618, when the future philosopher had joined the Dutch army in the city of Breda. During the final months of 1618, the two of them became intimate friends and discussed mainly mathematical and physical problems. Descartes dedicated his first work, *Compendium of Music* to Beeckman, who influenced Descartes' "physico-mathematical" theory of music. They lost contact after Descartes had moved on to Germany, but reestablished their friendship on Descartes' return to the Netherlands in 1628. However, partly because of some misunderstanding caused by a remark of **Marin Mersenne**, Descartes and Beeckman soon fell out with each other. Descartes accused his former friend of claiming to be his master, whereas, Descartes asserted, he had learned nothing from Beeckman that was worth mentioning. The two of them were reconciled to some degree, and Beeckman visited Descartes a few times in Amsterdam but died of consumption on May 19, 1637, in Dordrecht. In 1644 a small selection of his notes in the *Journal* was published as the *Centuria*, but this booklet was hardly noticed by contemporaries. It was only after the rediscovery of the *Journal* in the early twentieth century and its publication in 1939–53 that it was possible to establish the true nature of the relationship between Beeckman and Descartes.

By the time Descartes met Beeckman for the first time, the Dutchman had already fully developed his mechanical philosophy, which was based on two principles. The first was his assumption that matter consists of small particles moving in empty space, differing from each other only in geometrical form and **motion**. All substances in nature are made up of individual particles or specific combinations of particles (although Beeckman was an atomist, the real building blocks in his theory of matter were so-called *homogenea physica* or what we call molecules). The second principle concerned the science of **mechanics**. According to Beeckman, motion itself is not in need of an **explanation**. What needs to be explained is change in motion. An object, once it is set in motion, will never come to rest (or change

its course) unless it is impeded by another object. This is Beeckman's principle of **inertia**. It is not quite the modern concept of inertia, since it applies to both linear and circular motions, but it still constitutes a major revolution in mechanics since it inverts the Aristotelian principles that motion is always in need of an explanation and that only rest is a natural state of being.

Beeckman applied his two basic principles to the problem of free fall when he discussed this issue with Descartes in 1618. A couple of years before he met Descartes, Beeckman had already devised the corpuscular mechanism that is responsible for the phenomenon of free fall: the downward movement of heavy objects is caused by the constant pressure of particles of ethereal matter streaming to the earth from the sun (and the stars). Since the object retains the motion it receives from the first impact (the principle of inertia), the velocity with which it falls increases every time it is hit by a particle. It thus becomes exponential. However, Beeckman was unable to establish how exactly **time**, velocity, and the space traveled relate to each other. It was up to Descartes, with his superior mathematical ability, to provide the infinitesimal reasoning that enabled them to derive the correct relation between time and space traveled. Beeckman's corpuscular theory of matter and his principles of inertia remained a source of inspiration for Descartes during the rest of his life.

Although Descartes developed his own theory of matter, in which **body** and space are identical and thus a **vacuum** is impossible, there is a strong resemblance between Beeckman's micromechanical constructions – elaborated in the *Journal* – and Descartes' explanations of specific natural phenomena in the *Discourse*, and *Principles*. **Magnetism** provides a striking example of this resemblance. Descartes explains magnetism in the *Principles* by postulating a constant stream of small particles through the magnet and the object that is attracted by it; this is almost identical to the explanation Beeckman arrived at in his *Journal*. Upon publication of the *Principles* and the *Centuria* in 1644, some readers noted this resemblance and called into question Descartes' originality. There was therefore some reason for the ambitious Descartes in 1630 to deny his dependence on Beeckman so strongly as he did, for this dependence, though limited, was real.

See also Atom, Explanation, Inertia, Magnetism, Mechanics, Motion, Physico-Mathematics, Vacuum

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KLAAS VAN BERKEL

BEING, FORMAL VERSUS OBJECTIVE

In developing his first and, in many ways, most central argument for **God's existence** in the *Third Meditation*, Descartes invokes a distinction between two ways in which things may be said to be: *formally* and *objectively*. Formal being consists in the reality something possesses in virtue of existing; objective being consists in the reality something possesses whenever there is an **idea** of it. God is said to exist objectively in our idea of him, and while objective being or "being in the **intellect**" is generally diminished compared to the formal being of something existing outside the **mind**, it is not thereby nothing. Since it is "not nothing," the objective reality of an idea stands in need of a **cause** (AT VII 41–42, CSM II 28–29). The infinite degree of objective perfection of the idea of God implies God's **existence** (AT VII 45–52, CSM II 31–36). That this argument hangs on a rather dubious distinction between two modes of being was not lost on Descartes' contemporaries. **Johannes Caterus** responded that the Schoolmen would not take "objective being" to imply a mode of being distinct from formal being but simply the "**extrinsic denomination**" of a thing by the intellect (AT VII 92–93, CSM II 66–67). This is our first inkling that Descartes is not inventing the terminology and that there is no general consensus about how it was to be understood. Caterus represents one interpretation, but there were others in what was in fact a protracted medieval debate. Descartes' use of the terminology is obscure – "objective reality," "objective being," "objective intricacy," and "objective perfection" may seem to connote differently but are used interchangeably (see AT VII 161, CSM II 113–14; AT VIIIA 11, CSM I 198; AT VIIIB 362–63, CSM I 306) – and his indebtedness to tradition difficult to discern. We can only do so much in reconstructing the peculiar way in which he intends the distinction to be understood.

The *Third Meditation* purports to be "of God" but contains both a theory of ideas and an account of how ideas may be true or false. The two turn out to be connected because it is of the nature of ideas to be "as if images of things" (AT VII 3, CSM II 25–26; AT VII 43–44, CSM II 29–30), and in purporting to represent something,

an idea may thus be true or false (see **falsity, material**). Descartes' use of "image" does not mean that ideas are typically the product of **imagination** – he denies they are – but alludes rather to the late Scholastic use of "image" as implying two relations: similarity and causation by something with that similarity (see, e.g., Suárez, *De Mystério Trinitatis*, bk.9, ch.9, p.5; *Opera omnia* 25:747; Normore 1986, 235; Brown 2008). In the Aristotelian tradition, the transmission of forms (species) from material objects through the medium to the sensitive and intellective soul ensured that the causal process by which *phantasmata* were produced in the soul preserved similarity. Descartes, however, rejects the transmission of species and is forced to develop an alternative story about how ideas refer to objects and how they can be informative (see **species, intentional** and **representation**).

In addition to countenancing two modes of being, Descartes follows a long tradition in supposing that reality admits of degrees. The formal reality of a thing relates to its nature and actuality, for example, whether it is a **mode** or a **substance**, and what kind of mode or substance it is. The hierarchy of formal reality is established by considering whether the nature in question is dependent on something else or independent. Thus modes have less formal reality than the created substances upon which they depend, and everything has less reality formally than God upon which all things depend for their existence. This scale of formal reality is reflected hierarchically in the objective reality of ideas. An idea of a substance contains more objective reality than an idea of a mode, and the idea of God the greatest conceivable objective reality (AT VII 41, CSM II 28–29).

Ideas, therefore, are unique in being measurable along two dimensions of reality. Considered as modes of thinking (*modi cogitandi*) or *formally*, all ideas are the same. Considered in terms of what they represent, or their objective reality, they vary considerably. The crucial move in the first argument for God's existence consists in Descartes' extending the causal principle "that there should be at least as much being in an efficient and total cause as in the effect of that cause" to the objective reality of an idea (AT VII 41, CSM II 28–29). More precisely, the first and principal cause of the objective reality of an idea must contain *formally* all of the reality contained *objectively* in the idea. The requirement that there must exist an actual cause with all the reality represented in the idea it causes, in conjunction with the argument that the idea of God contains infinite objective perfection, clinches the argument for God's existence (AT VII 45, CSM II 31) (see **cosmological argument**).

In the First Objections, Caterus accuses Descartes of equivocating when he says that "the mode of being by which a thing exists objectively in the intellect ... is certainly not nothing, and so it cannot come from nothing." "Nothing" may mean "not anything actual," in which case no cause is needed, or it may mean something imaginary or a mere being of reason. Because he wants to distinguish objective being from actual, formal being, Descartes cannot mean the first, but if he means the second, objective being is "merely conceived" and so does not need a cause (AT VII 93–94,

CSM II 67). For many Scholastic philosophers, including Caterus and **Suárez**, mere beings of reason would include privations and **universals**, simple ideas of which cannot require a positive being possessing formally the characteristics represented in their ideas (Wells 1990, 50–58). There is good reason to expect Descartes to agree (Nolan 1998).

In his reply to Caterus, however, Descartes presents an **analogy** that is supposed to show why a thing “needs a cause enabling it to be conceived.” Consider, he says, the case of someone thinking about a highly intricate **machine**. When we ask for the cause of the person’s thinking being about this machine, it will not do to point out that the machine is not actual and so no cause is needed. Nor is appealing to the mind’s power to cause its own operations sufficient, for this does not explain why the person is thinking about that machine and not something else. Whatever the cause – for example, whether the idea is caused by a real machine of such-and-such intricacy, or extensive **knowledge of mechanics**, or a very subtle intelligence – it has to be something positive (not “a defect in my nature”) and possess formally or (here Descartes adds) *eminently* as much intricacy or perfection as is represented in the design of the machine (AT VII 104–5, CSM II 75–76; cf. AT VIIIA 11, CSM I 198) (see **containment, eminent versus formal**). But while these very different causes may account for the degree of reality represented in the idea of an intricate machine, it is not so obvious how they help to explain what makes it the idea *of* that intricate machine.

It is perhaps because of such obscurities in Descartes’ explanation of objective reality that some scholars are inclined to treat his usage of the terminology in a somewhat deflationary manner. On one such interpretation, the objective reality of an idea merely indicates the *degree* of formal reality of the idea’s object, which, it is argued, is sufficient for Descartes to make the argument for God’s existence. The objective reality of an idea on this view neither determines the representational content of an idea nor signifies a special mode of being objects may have apart from their formal existence (Nelson 1996, 17–18).

It is hard to reconcile this interpretation with texts such as the exchange with Caterus where Descartes insists that objective being signifies “being in the intellect” (AT VII 102, CSM II 75). It is also unclear what *could* determine the representational content of an idea if its objective reality does not. In evoking the terminology of objective reality, Descartes distances himself from relying solely on a causal criterion to account for what ideas represent (from reducing meaning to reference, we might say). And the formal reality of ideas is not sufficient to determine their content. In the *Preface to the Reader* of the *Meditations*, Descartes introduces another distinction between ideas taken “materially” (*materialiter*), as acts of the intellect, and ideas taken “objectively” (*objective*), that is, in terms of what is represented by those acts (AT VII 8, CSM II 7). “Material” and “formal” are ways of talking about an idea as a mental operation – *materially*, as a mode (of mind), and *formally*, as a representing

activity, the kind of activity by which things become known. But what an idea represents is not accounted for by either of these aspects of an idea – that is left to the objective reality of the idea: “the being of the thing which is represented by an idea, in so far as it exists in the idea” (AT VII 161, CSM II 113; cf. Smith 2005).

Here Descartes’ use of the terminology is consistent with tradition. In the commentary tradition there was considered to be a puzzle about how a form could inhere in the matter of the medium and sense organs without thereby creating a hylomorphic unity with matter. There were also puzzles in the optical tradition about how forms were perceived, following Aristotle’s suggestion in *De Anima* III (418b27; 422b1 ff.) that a form’s being present in the usual way (e.g., if the eye were colored green) would interfere with the reception of the form in a knowable mode of being. A widely accepted answer to such puzzles involved supposing that the forms exist in the medium or the sense organs in an unusual way, and various terms were introduced to describe this alternative mode of being, including *esse obiectivum*. It is not unreasonable to suppose that in Descartes’ theory of ideas the similarity between an idea and what it represents is a function of the identity between the idea and its object: “The idea of the sun is the sun itself existing in the intellect” (AT VII 102, CSM II 75). This is, of course, to take Descartes literally, but the alternative – that he might be speaking only figuratively of the sun being contained in the idea – does not warrant his talk of two modes of being (Alanen 2003, ch.4; Normore 1986; Hoffman 2002).

If this is the right way to understand Descartes’ use of the terminology of objective reality, then it raises some difficulties. Some commentators deny that it makes sense to suppose an identity between the thing that exists objectively in an idea and the thing that exists formally outside the mind but without identity, Descartes’ aspirations to direct realism are directly compromised (see AT VII 8, CSM II 7). If my mind is immediately acquainted only with objective beings, it seems “that I cannot think (immediately) about the real sun (or real God!)” (Ayers 1998, 1068; cf. Chappell 1986). If we respond by insisting that the sun objectively existing is not really distinct from the real sun but is the very sun itself in a special mode of being, a second problem emerges. How is it possible for an extended substance, the real sun, to be identical with an idea – a mode of unextended, mental substance (Normore 1986, 238; Ayers 1998, 1067)?

It should be noted that speaking of Descartes as a direct realist is controversial (see Hoffman 2002), but the alternative reading of him as a representational realist carries with it all the skeptical problems associated with postulating a “veil of ideas” (or objective beings) between us and the world (Boyce Gibson 1932, 79). Although we cannot hope here to eliminate the grounds for thinking that Descartes’ objective existence theory of ideas commits him to representational realism, we can defuse it somewhat by observing that objective beings are *not* intentional objects in the modern sense, which assumes them to be mind dependent (see **representation**).

Despite Descartes' talk of objects being "in the intellect," he intends them to have a mind-independent status. Arguably, objective *entia* are *possibilia*, which depend for their being on God's intellect and will. This is made clear at the beginning of the Fifth Meditation in which he argues that from the fact that he can clearly and distinctly demonstrate the properties of a triangle even if none exist "outside my **thought**," he knows there to be "a determinate nature or essence ... which is immutable and eternal, and not invented by me or dependent on my mind," "something ... not merely nothing" (AT VII 64–65, CSM II 44–45) (see **true and immutable nature**). If formal reality implies actuality, then triangles have objective and possible but not formal being. Elsewhere Descartes asserts that "possible existence is contained in the concept or idea of everything that we clearly and distinctly understand" (AT VII 116, CSM II 83), and in the **Geometrical Exposition** of the *Second Replies* postulates it as an axiom that possible or contingent existence is contained in the concept of every thing other than God (AT VII 166, CSM II 117). It follows that if an idea has objective reality, and is thus of a thing, that thing possibly exists (Normore 1986, 238). The nature or **essence** of a triangle, therefore, is a possible being, which, not being dependent on my mind, must be caused by God. All this suggests that Descartes is equating objective reality with objective being and possible being (siding thereby with the Scotists that the possibles have *esse reale*) (Normore 1986, 232–33; Wells 1990, 60).

On this reading, our clear and distinct ideas connect us directly with a mind-independent reality of essences, **eternal truths**, and actuality. This may only substitute one skeptical question for another – how it is that we can tell whether we are thinking of an actual rather than merely possible thing – but it is a step up from the problem created by supposing that the direct objects of thought are mind dependent. And for Descartes this kind of skepticism is not particularly deep, for it is only in the case of the idea of God that we can infer from its objective reality that God actually exists. The more general solution to skepticism must follow from this unique feature of the idea of God.

The second problem is harder to defuse for want of supporting texts. But if we are correct in supposing that the objective reality of ideas is a product of God's will and not our own, then for all the talk of "objects being in the intellect," it is unclear that Cartesian ideas supervene only on the intrinsic properties of the mind. They seem rather to be *unions* between the mind and external (possible or actual) beings, rendered intelligible by God. Like other infamous unions in Descartes' ontology, it is not necessary for the mind to share a common nature with the objects it thinks about through its ideas. Seeing the difficulties inherent in such a position, however, **Malebranche** opts for wholly externalizing ideas in the mind of God, collapsing them into the "archetypes" Descartes takes to be their causes, and supposing that God intervenes directly in causing each of our thoughts. Descartes does not go so far, but if the preceding reading is correct, he is further down this path than we might have initially thought. The "sun's existing

in the intellect” is code for the mind’s union with an object rendered intelligible by God, a fitting conclusion perhaps for a view that holds that everything, including thought, is ultimately dependent on God.

See also Cause; Cosmological Argument; Containment, Eminent versus Formal; God; Idea; Mode; Representation; Substance; Thought; True and Immutable Nature

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DEBORAH BROWN

BÉRULLE, PIERRE DE (1575–1629)

Born in the Champagne region, Bérulle was one of the leading religious figures in early seventeenth-century France. He is known primarily for his mysticism and his intolerance of Protestants. Ordained in 1599, Bérulle founded (1611) the Society of the Oratory of Jesus, also referred to as the Congregation of the French Oratory, a congregation of priests (known as **Oratorians**) dedicated to the reformation of the clergy. The society quickly flourished, and within a few decades was running dozens of colleges

and seminaries throughout France. While Bérulle spoke approvingly of Descartes' **philosophy**, his own interests were in theology – where he was heavily influenced by the Neoplatonism of both pseudo-Dionysius and **Augustine** – and politics. His most popular work was *Discours de l'état et des grandeurs de Jésus* (1623). Bérulle was made a cardinal by Pope Urban VIII in 1627.

As for his links to Descartes and **Cartesianism**, Bérulle's Augustinianism was transmitted both directly, through personal relations he had with men who would later have connections of their own with Descartes, such as Charles de Condren and **Guillaume Gibieuf**, and indirectly, via the Oratorian seminaries to others who would later become Cartesians themselves, such as André Martin and **Nicolas Malebranche**. Of particular note is Gibieuf. It was through Bérulle's influence that he rejected Molinism, to which he had shown some leanings, and through Bérulle's encouragement that he wrote his anti-Molinist book *De libertate Dei et creaturae* (1630), which argued that **free will** is essentially a matter of spontaneity. Years later, Descartes would make a point to tell **Mersenne** that he “wrote nothing [in the *Meditations*] which is not in accord with what [Gibieuf] said in his book *De Libertate*” (AT III 360, CSMK 179).

A second link between Bérulle and Descartes comes from a story told by **Baillet**, one that is often repeated although is unlikely to be entirely true. According to the story, in the fall of 1628 both Descartes and Bérulle attended a talk given by a Monsieur Chandoux. When the talk concluded, Bérulle noticed that Descartes alone did not applaud. Asked about this, Descartes replied that while he shared Chandoux's anti-Scholasticism, he did not think skepticism could be avoided if one did not begin with premises that were known with absolute **certainty**. Very much impressed with this, Bérulle met privately with Descartes some days later, telling him it was his duty to **God** and to his fellow man to go somewhere where he could be alone and put his philosophy in writing. As the story goes, this encouragement led Descartes to leave Paris in late 1628 or early 1629 to spend the next twenty years in relative solitude in Holland. While the veracity of this story, at least the part about the private meeting and Bérulle's exhortation to Descartes that he fulfill God's plan for him by writing works of philosophy, is questionable, what is known for sure is that Bérulle did not live long enough to see any of Descartes' thought in print. He died in Paris on October 2, 1629.

See also Augustine, Aurelius; Baillet, Adrien; Gibieuf, Guillaume; Malebranche, Nicolas; Oratorian

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FRED ABLONDI

BEVERWIJCK, JOHAN VAN (1594–1647)

Born at Dordrecht, Van Beverwijck studied **philosophy** and **medicine** at Leiden (1611), then made a European tour, which he wrapped up with a graduation at Padua (1616). On returning to Dordrecht, he became town physician (in charge of the poor) and held several administrative offices. Van Beverwijck's work is mainly important for its contribution to popular medicine. His *Schat der gesontheyt* (*Treasure of Health*) and *Schat der ongesontheyt* (*Treasure of Disease*) are self-help manuals, for which he secured the collaboration of the poet Jacob Cats (1577–1660), who put Van Beverwijck's maxims into short rhymes. Other books take the form of an epistolary exchange, for example, on the question whether the end of life is fixed beforehand (so there is no point in fighting disease).

Van Beverwijck's contacts with Descartes in June 1643 (AT III 682) are part of a similar project: he wants Descartes' **explanation** of the circulation of the blood for *Epistolicae Quaestiones* (1644). In his reply of July 5, 1643 (AT IV 3–6), Descartes marks his position with respect to **William Harvey** (1578–1657), more clearly than he had done in the *Discourse on Method* (AT VI 50–51, CSM I 136–37). He agrees with Harvey on the circulation of the blood but disagrees on the movement of the **heart**: whereas Harvey believes that the blood is pushed out by a contraction of the heart (*systole*), Descartes believes that the blood forces itself out by expanding under the influence of heat, that is, at the precise moment in which, according to Harvey, the ventricles relax (*diastole*) – which is also the view of modern medicine. Descartes' main reason, however, to react positively to Van Beverwijck's request may have been that it provided him with an opportunity to publish his correspondence with **Plempius** (1601–71), Plempius's own publication of it (in *Fundamenta medicinae* 1638) being incomplete. There is no trace of a specifically Cartesian influence in Van Beverwijck's own work.

See also Harvey, William; Heart; Plempius, Vopiscus Fortunatus

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THEO VERBEEK

BODY

Ontologically, a body (Latin *corpus*; French *corps*) is nothing but **extension**, its principal attribute, just as a **mind** is nothing but **thought** (AT VIIIA 25, CSM I 210). As the famous **wax** experiment of the Second Meditation shows, a body is not the same as its color, smell, **shape**, or **motion**, but instead merely something “capable of being extended” in many different ways (AT VII 31, CSM II 21). Not even solidity, in the sense of felt hardness, pertains to the **essence** of body since a body would retain its nature even if it always receded from our touch (AT VIIIA 42, CSM I 224). Solidity in the sense of impenetrability does pertain to the essence of body since penetration implies co-location and co-location implies annihilation: “But what is annihilated does not penetrate anything else” (AT V 342, CSMK 372). Besides being extended, bodies are by nature divisible and quantifiable, but Descartes emphasizes that **divisibility** (AT IXB 53, CSM I 215n1) and quantity (AT VIIIA 44, CSM I 226) are themselves merely conceptually distinct from extension and hence from body itself. Finally, since our strict notion of space (what Descartes calls “internal place”) is also simply extension, it follows that “in reality the extension in length, breadth, and depth which constitutes a space is exactly the same as that which constitutes a body” (AT VIIIA 45, CSM I 227). Consequently, a **vacuum** or “empty space” is impossible (AT VIIIA 49, CSM I 229–30), and the body comprising the universe is unlimited and unified (AT VIIIA 52, CSM I 232). So “body considered in general,” or generic matter, consists simply in “being something which is extended in length, breadth and depth” (AT VIIIA 42, CSM I 224).

For the purposes of first philosophy, it does not concern Descartes that this austere, geometrical conception of body is far removed from the diverse phenomenology contained in our familiar experience of objects. And yet the purpose of natural philosophy is to explain the regular phenomena of nature from first principles and laws. So Descartes needs to bridge the gap between body in general and natural bodies. Unlike the parts of a purely geometrical space, there are intrinsic, persistent differences among natural bodies. And associated with these differences are diverse but regular behaviors. In lieu of Aristotelian forms or Epicurean voids, Descartes individuates bodies by relative motion: “By ‘one body,’ or ‘one piece of matter,’ I here understand everything which is simultaneously transported” (AT VIIIA 53–54, CSM

I 233). According to Descartes' version of creation, **God** produces generic matter and then "really divides it into many such parts, some larger and some smaller, some of one shape and some of another" (AT XI 34, CSM I 91). These bodies form three basic **elements**: the indefinitely small, the small but definite, and the bulky (AT VIIIA 105, CSM I 258). The various interactions among these elements, in accordance with universal laws of motions and specific rules of collision, give rise to the regular phenomena of nature: **light**, **gravity**, celestial motions, **rainbows**, the heart-beat, and so on.

Descartes' method of individuating bodies contained within generic extension, via relative motion, is problematic in a number of ways (see Sowaal 2004). Most obviously, it looks to be viciously circular since relative motion – that is, "the transfer of one piece of matter, or one body, from the vicinity of the other bodies which are in immediate contact with it" (AT VIIIA 53, CSM I 233) – already presupposes distinct bodies. Furthermore, as **Leibniz** observed, it seems to imply that at an instant, when there can be no motion, the world is a homogeneous plenum. Finally, it is unclear whether bodies so individuated can count as Cartesian **substances**. Descartes defines a finite substance as what depends only on God to exist (unlike **modes** and qualities, which depend on the things in which they inhere) (AT VIIIA 25, CSM I 210). But, as **Spinoza** observed, bodies individuated by relative motion, rather than vacua, depend on the surrounding bodies (see Slowik 2001). And in the Synopsis to the *Meditations*, Descartes implies that, unlike the mind, the human body is not a "pure substance," less so even than "body in general," since our body is "simply made up of a certain configuration of limbs and other accidents" (AT VII 14, CSM II 10). If individual bodies nevertheless somehow qualify as substances, other difficulties arise. For one thing, it is unclear how many of them there are. In one passage, Descartes indicates that "each and every part" of corporeal substance "as delimited in our thought" are no less distinct than our mind and our body (AT VIIIA 28, CSM I 213). In another, he argues that in some circular motions "the resulting subdivisions are so numerous that however small we make a particle in our thought we always understand that it is in fact divided into other still smaller particles" (AT VIIIA 59–60, CSM I 239) (see **divisibility**). For another thing, it seems to follow that the material universe as a whole is not a substance since it depends on the individual substances that compose it (see **individuation**).

There is one individual body, namely the living human organism, which might avoid these difficulties by deriving its identity and individuality from the immaterial soul to which it is united (see Hoffman 1986). Despite the remark in the Synopsis about our bodies being mere concatenations of accidents, Descartes seems to embrace a hylomorphic conception of the human body in a letter to **Mesland**: "I do not believe there is any particle of our bodies which remains numerically the same for a single moment, although our body, *qua* human body, remains always numerically the same so long as it is united with the same soul" (AT IV 167, CSMK 243).

But it is far from clear whether such an account is consistent with Descartes' strict **dualism** (and anti-Aristotelianism), and there are many other passages, especially in the physiological writings, that undercut any fundamental difference between the individuality of human bodies and other sorts of bodies. In the *Passions of the Soul*, for example, he insists that "the difference between the body of a living man and that of a dead man is just the same as the difference between, on the one hand, a watch or other automaton (that is to say a self-moving **machine**) when it is wound up ... and, on the other hand, a watch or a machine when it is broken" (AT XI 330–31, CSM I 329–30).

See also Attribute, Divisibility, Element, Extension, Form, Substantial, Individuation, Law of Nature, Mind, Plenum, Substance

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GEOFFREY GORHAM

BODY, PROOF OF THE EXISTENCE OF

In the *Meditations*, Descartes seeks to prove the **existence** of the external world in a series of five dialectically linked proofs. The first, in the so-called painter analogy of the First Meditation, investigates whether our ability to have dream representations (likened there to paintings of objects) presupposes acquaintance with material objects external to the **mind**, finding that it does not. What is presupposed, rather, is that there is a class of "simpler and more universal things ... [which] include corporeal nature in general, and its **extension**; the **shape** of extended things." These things "are as it were the true colour from which we form all the images of things" and play this role "whether they really exist in nature or not" (AT VII 20, CSM II 14).

The second and third attempts take place in the Third Meditation, comprising two different applications of causal principles to **ideas**, the first (paras. 8–11) to ideas considered "materially," that is, as mental occurrences ("method 1"); the second (paras. 12–21) to ideas considered "representatively," that is, as mental occurrences that represent one thing rather than another ("method 2"). The first method

fails largely because of the possibility that there is *inside me* a capacity (“faculty”) for producing sensory ideas, as there apparently is in the case of dreams.

The second method contains the heart of Descartes’ causal epistemology, most perspicuously formulated in Axiom V of the **Geometrical Exposition** in the Second Replies: “The objective reality of our ideas needs a **cause** which contains this reality not merely objectively but formally or eminently.” The objective reality of an idea seems to be a reality that Descartes attributes to objects of our ideas regardless of whether those objects actually exist, and the formal containment of the reality is attributed to objects when they actually exist (see **being, formal versus objective**). There is a controversy about what “reality” refers to: Does it refer to a metaphysical category like *being a finite substance* or does it refer to a specific property, like *being an intricate machine of a particular kind*? Following Radner (1985), we adopt the second, especially when the causal principle is involved. Descartes goes on to assert that this **axiom** has general epistemological significance: “It should be noted that this axiom is one which we must necessarily accept, since on it depends our knowledge of all things, whether they are perceivable by the senses or not” (AT VII 165, CSM II 116).

In the Third Meditation, we find this same axiom applied. If one can show that the cause of the objective reality of any of my ideas “does not reside in me either formally or eminently,” then one knows that something exists other than oneself (AT VII 42, CSM II 29). We can now represent the general template for existential proofs as a matrix of possible outcomes:

Property F in my idea exists in me formally	Property F in my idea exists in something outside me formally
Property F in my idea exists in me eminently	Property F in my idea exists in something outside me eminently.

Though not all existential arguments are elimination arguments for Descartes, in the case of the argument for the existence of **God** in Meditation III, Descartes argues successfully for the elimination of the left-hand column. However, our interest is not with this application but with the unsuccessful application, also an elimination argument, to the case of corporeal objects. This application fails because “all the other elements which make up the ideas of corporeal things, namely extension, shape, position and movement, these are not formally contained in me, since I am nothing but a thinking thing; since they are merely modes of a substance, it seems possible that they are contained in me eminently” (AT VII 45, CSM II 31). The failure of the existential-proof template for corporeal objects occurs because of this possibility, the bottom left-hand cell of the matrix.

To understand the failure, we have to examine the distinction between formal and eminent containment. We are supposing that the contained reality is a property

and that property F is contained *formally* in a substance x only if x is actually F, but F is contained *eminently* in x only if F is contained in an abstract form in x and x is not actually F. Thus, if F is the property of *being this watch*, F is contained formally in the watch itself but is contained abstractly, that is, eminently, in the mind of the designer as a plan for constructing the watch (see AT VIIIA 11, CSM I 198–99) (see **containment, eminent versus formal**). Returning now to the application of the proof template in the case of corporeal ideas, we can see that it failed because of the possibility that the representational capability of all ideas of corporeal things is due to the *abstract* containment of corporeal nature in the mind. This is what Descartes must somehow discount in the final two stages of the dialectic in the Sixth Meditation.

In the fourth stage, Descartes explains that our ability to have mental images (pictures) of objects, even when they are not present to our senses, is due to the mind “looking at” images in the brain, just as our ability to have intellectual ideas of objects requires our “looking at” abstract intellectual objects, the **essence** of corporeality of which we have just been speaking. But Descartes is cautious here about advancing such a theory of how the **imagination** operates, claiming that such a theory is a merely “probable conjecture” (AT VII 73, CSM II 51).

In the first four stages of the *Meditations*’ attempt to derive the existence of the physical world, Descartes maintains that he has been unsuccessful. It is only in the fifth, and final, stage of the dialectic that he is able to show by an elimination argument that the physical world actually exists. In the final stage he establishes, first, that he is a thinking substance, distinct from any bodily substance. Next, he considers ideas of sensible objects, maintaining that they “are often produced without my cooperation, even against my will.” He assumes that any cause lying within the mind would be transparent to introspection. This has been dubbed the doctrine of the “epistemological transparency” of mind (Wilson 1978, 44). But, noticing no such internal cause, Descartes concludes that his sensory ideas must have a source outside of him. Then, he states a causal principle virtually identical in formulation to Axiom V: “Therefore, the only alternative is that it [the cause of my sensory ideas] is in some substance different from me, containing either formally or eminently all the reality that exists objectively in the ideas produced by that faculty” (AT VII 79, CSM II 55). The reality is, of course, corporeal. So we should now expect to find an argument structure fitting the general template of existential proof. And this is just what we do find. To reach his conclusion, “corporeal things exist,” Descartes proceeds by elimination of all but the “formal/outside me” cell in the proof matrix. As noted, he has already eliminated the “source is inside me” column. In the final step, Descartes appeals to a “great propensity” we have to believe that there are material objects. This propensity would generate false beliefs if ideas of sensible objects were caused not by objects in which corporeality is formally contained but by a godlike figure in whose mind corporeality is eminently contained, perhaps as an abstract plan for the production of the corporeal world. Descartes maintains that we cannot rule out this

possibility by applying the template of existential reasoning by itself, so he supplements that template by appealing to the nondeceiving nature of God. Since God would be a “deceiver” if the possibility of eminent containment were permitted, it is not permitted. This leaves only the top right-hand cell of the matrix in play (where F is the property of corporality).

How are we to assess this argument? Suppose we ask this question in relation to the dialectic that Descartes has so carefully crafted beginning in the First Meditation: each subsequent step removes an impediment that caused the failure of its predecessor. The first step is an empiricist gambit that is checkmated by Descartes’ nativism: ideas represent corporeal things because they represent or perhaps are constituted by essences of corporeal things, and these, we learn in the Fifth Meditation, are innate. The second step (method 1 in the Third Meditation) sidesteps nativism by changing the subject: it is now ideas considered materially rather than representatively whose provenance is under consideration. The possible internality of the cause of such ideas arises because of Descartes’ view that our brains might be the autonomous causes of our dreams and our brains might still count as “internal to us.” The obstacle is removed when it is shown in the Sixth Meditation that we are distinct from our bodies (see Newman 1994). But the third step (method 2 in the Third Meditation) reintroduces ideas as representational and reaffirms nativism, this time in the language of eminent containment. But if the possibility that corporeal properties are contained only eminently in the mind is not removed, then the actuality of the corporeal world remains unproved. How is this possibility removed in the final step? Much depends on how we understand the “great propensity to believe that they [ideas of sensible objects] are produced by corporeal things” (AT VII 79, CSM II 55).

Ideas of sensible objects (*ideas rerum sensibilium*) are not **sensations** but ideas of corporeal substances, and thus have explicit corporeal representational content. It may therefore be that the “great propensity” is a strong tendency to believe that both the occurrence and the content of ideas of sensible substances be explained by actual corporeal things (AT VII 79, CSM II 65). This is contrary to an intellectualist-nativist reading in which occurrence of these ideas, though their content is afforded by the objects of the intellect (see De Rosa 2010, 171–74), is still due to corporeal objects, but it is consistent with an imagistic reading, to which we now turn (cf. Vinci 2008).

Although an imagistic interpretation of sensory ideas of corporeal objects will seem surprising for a text in the *Meditations*, elsewhere Descartes defines the perception of corporeal objects (“sensory perception”) in terms of the ideas of the imagination: “When external objects act on my senses, they print on them an idea, or rather a figure, of themselves; and when the mind attends to these images ... it is said to have sensory perception” (AT V 162, CSMK 144). If the ideas of sensible substances are thus understood, then we should be applying the template for general existential

proof to ideas of this kind. But has not Descartes already considered, and dismissed, this possibility in the fourth-stage argument of the Sixth Meditation? But things have changed between then and the final stage: we now understand ourselves to be a mind distinct from the **body**, so we can prove conceptually that the cause of the objective reality of imagination ideas of corporeal objects cannot exist in me formally. For the same reason we can now rely on introspection to show that the cause of my imagination ideas does not exist inside me in any form, hence not eminently. This then delivers what is needed for the final gambit: the cause of the objective reality of my imagination ideas of corporeal objects lies in something outside me either eminently or formally. As noted, the nondeceiving nature of God rules out the former; hence, only the latter remains. “It follows that corporeal things exist.”

The “great propensity” to believe in the existence of bodies may also be read as the “great inclination” mentioned in the Fourth Meditation that is occasioned by *clear and distinct perception* (AT VII 59, CSM II 41) (see Field 1985; cf. Wee 2002). Support for such a view can be found in another version of the proof that Descartes provides in the *Principles of Philosophy*. There the argument runs much as it has in the Sixth Meditation until we come to this passage: “We appear to see clearly that the idea of it [corporeal things] comes to us from things located outside ourselves, which it wholly resembles” (AT VIIIA 40, CSM I 223). Garber (1992, 70–75) notes that this declaration differs in two important respects from statements made in the Sixth Meditation proof. First, there is the language of “occasioning,” which might here be used in deliberate contrast with the language of causation so prevalent in the latter proof. Second, there is the claim that we have “clear” cognition that the cause of our ideas of corporeal objects is itself formally corporeal. This is the significance of the language of “resemblance” at the end of the sentence quoted. We shall focus on the second. Assuming that when “we appear to see clearly that the idea [of corporeal things] comes to us from things located outside us,” we are in fact perceiving clearly and distinctly (in Descartes’ technical sense) that this is the case, his doctrine is that we are *compelled* to assent to the existence of corporeal objects as if this were immediately obvious. In this case, the alternative possibility of eminent containment of corporeal properties is ruled out automatically – indeed, no reference to eminent containment is made here – and the role for God as a nondeceiver would then seem to have shifted to that of a validator of clear ideas in the *Principles* proof from that of a benevolent upholder of commonsense beliefs in the proof of the Sixth Meditation (*ibid.*, 71–72). However, it is difficult to see what aspect of Descartes’ theory of clear and distinct perception would justify treating it as immediately obvious that the cause of our sensory ideas of corporeal things are actual corporeal things. This difficulty can be avoided if we suppose that when Descartes says “we appear to see clearly that the idea [of corporeal things] comes to us from things located outside us,” he is speaking colloquially, meaning that *we are strongly inclined to assent* to this. If so, the difference between the two proofs may be more apparent than real.

See also Clarity and Distinctness; Containment, Eminent versus Formal; Existence; Extension; Idea; Knowledge; Being, Formal versus Objective

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THOMAS VINCI

BOURDIN, PIERRE (1595–1653)

In 1640, Bourdin, a **Jesuit** and mathematics professor at Clermont College in Paris, challenges in public disputation several theses of Descartes' *Dioptrics*. Descartes reacts angrily. First, he is outraged that the objections were not sent to him before being publicized. Second, because he was hoping that the **Jesuits** would support and disseminate his views, Descartes perceives Bourdin's challenge as a flat rejection and the sign of a coming offensive by the whole order. Indeed, Descartes is persuaded that the discipline within the Society of Jesus is such that none of its members speaks without expressing the opinion of the whole body. Thus, in order to avoid having to fight one Jesuit after another, Descartes writes to the rector of Clermont College to demand that any Jesuit criticizing him be officially commissioned. He also suggests that the society choose another champion in place of Bourdin, whom he regards as incompetent and on whom he repeatedly pours scorn. Otherwise, Descartes threatens, he will write a systematic refutation of Scholastic philosophy and science taught in Jesuit colleges, presented alongside his own to the advantage of the latter (this project would eventually lead to the *Principles of Philosophy*, after Descartes gave up the critical part).

The response is not as Descartes expects. In 1641, Bourdin, uninvited by Descartes or by **Mersenne**, raises objections against the recently released first edition of the *Meditations*. This time, the criticisms are conveyed privately to Descartes. But Bourdin also proposes a nonaggression pact: he will not publish his objections if Descartes refrains from writing against the Jesuits. Again, Descartes takes Bourdin's piece as the reaction of the whole society and, indignant, does not waver. He adds Bourdin's objections (known as the Seventh Objections, which are the longest set), along with his scathing replies, to the second edition of the *Meditations* (1642). He also appends an open letter to the head of the French Jesuits, **Dinet**, in which he attacks both Bourdin and the Dutch Calvinist theologian **Voetius** (AT VII 449–603, CSM II 303–97).

By the end of 1642, Descartes is more or less reconciled with Bourdin and the Jesuits. Still, Bourdin's objections might indeed reflect the society's negative judgment on Descartes' thought. Notably, Bourdin does not engage with particular theses but aims at the *Meditations*' **method**. In the first place, he points out that once we admit that we do not know whether we are awake or dreaming, sane or insane, we will never recover certitude about anything. As a matter of fact, "it is not certain that what appears as certain to someone who is in **doubt** whether he is awake or asleep, is in fact certain" (AT VII 457, CSM II 307), but the *cogito* is discovered by a **mind** that does not yet know whether it is slumbering or demented. Similarly, the official condemnations of **Cartesianism** in the second part of the seventeenth century reveal that one of the things the Jesuits disliked was the appearance of skepticism in Descartes' method (Ariew 1995, 222). They feared that once having set a foot in Pyrrhonism, one could never pull out, and Pyrrhonism, in their eyes, was linked to atheism (Voetius hurls similar accusations against Cartesianism). However, in his letter to **Dinet**, Descartes vehemently argues that he presented reasons for doubting only as physicians describe the diseases they intend to cure and that Bourdin is the one who fosters atheistic skepticism when considering it as a position that cannot be refuted with utmost certitude (AT VII 548–49, CSM 374–75).

See also Certainty; *Cogito Ergo Sum*; Dinet, Jacques; Doubt; Jesuit; *Meditations on First Philosophy*; Mersenne, Marin; Optics; *Principles of Philosophy*; Voetius, Gysbertus

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JEAN-LUC SOLÈRE

BOYLE, ROBERT (1627–1691)

The seventh son of Richard Boyle, first Earl of Cork, the Right Honorable Robert Boyle became the foremost natural philosopher in Britain in the period immediately before **Newton**. Educated by private tutors, he began his career as a lay religious thinker and moralist. Always extremely devout, he turned to the study of the natural world in order to develop a natural theology; many of his most important works use natural phenomena to argue for the **existence** and benevolence of **God**. These include *Some Considerations Touching the Usefulness of Experimental Natural Philosophy* (1663), *A Discourse of Things above Reason* (1681), and *The Christian Virtuoso* (1690). He began by setting up an alchemical laboratory in his manor house at Stalbridge in Dorset. In 1654 he moved to Oxford where he took on Robert Hooke (1635–1703) as his assistant, and became part of the circle of natural philosophers who were to help set up the Royal Society in 1660. Boyle's alchemical studies embraced the theories of Daniel Sennert (1572–1637) and others who had developed a corpuscular theory of alchemy, and so he was well placed to embrace the corpuscular **physics** of Descartes. According to John Aubrey (1626–97), author of the biographical notes later published as *Brief Lives* (1898), it was Robert Hooke who “made him understand Des Cartes’ Philosophy,” and Boyle was one of the first to characterize Descartes’ **philosophy** as the “mechanical philosophy.” Boyle was never a full-fledged Cartesian, however, because his alchemical and other experimental studies and his religious sensibilities convinced him that matter could be endowed with principles of activity.

Boyle also embraced the belief, advocated by **Francis Bacon** (1561–1626) and later promoted by the Royal Society, that reform of natural **knowledge** was best accomplished by gathering facts, without allowing any preconceived ideas or theories to dictate what supposed “facts” were important. Bacon's inductivist experimentalism, in which experiments are not (must not be) designed to test a hypothesis but are merely intended as ways of gathering more facts, is generally regarded by philosophers of science as unworkable. Certainly, in many of his experiments Boyle can be seen to have been following what is now recognized as the (decidedly un-Baconian) hypothetico-deductive **method**; nevertheless, it cannot be denied that, in some of his works at least, Boyle came closer than anyone else to exemplifying the Baconian method. Some of his most important works were attempts to provide the kinds of “natural histories” of phenomena advocated by Bacon: *New Experiments Physico-Mechanical Touching the Spring of the Air* (1662), *Experiments and Considerations Touching Colours* (1664), *New Experiments and Observations Touching Cold* (1665), *Memoirs for the Natural History of Humane Blood* (1684), and others. It was Boyle's perceived Baconianism that made him so respected among contemporaries, especially in Britain, where Bacon's influence was strongest. Boyle's Baconianism also ensured that he could not endorse Descartes' essentially rationalist approach to knowledge.

Boyle believed that his commitment to a corpuscular mechanical philosophy could be justified experimentally and therefore made compatible with his Baconianism: corpuscular **explanations** were intelligible and persuasive because they were based on the kind of physical explanations familiar to us from everyday experience. While developing these claims, he was led to make the distinction between primary and secondary qualities, which was subsequently taken up by **John Locke**.

See also Bacon, Francis; Experiment; Locke, John; Method; Physics

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JOHN HENRY

BRASSET, HENRI (1595–AFTER 1657)

Brasset became secretary of the French *resident* (permanent representative) in Brussels in 1616. In 1627 he became secretary of the French Embassy in The Hague and, in 1634, resident. With a short interruption in 1645–46, when he took part in the talks that would lead to the Peace of Westphalia (1648), he remained in The Hague until 1654. He returned to France, “old and blind” it seems and bitter because the States General had not given their usual gratification. He spent his last years in impoverished circumstances, also because his wages had never been paid. It is not known when he died. The first time Brasset is referred to by Descartes is simply as one who could

introduce him to the ambassador (AT IV 23–25). Over the years, however, their relations became more familiar; in his last letter to Descartes, Brasset speaks of his little daughter Marie-Charlotte as someone whom Descartes knows and loves (AT V 450). Brasset's intimate knowledge of the official world proved valuable during Descartes' conflicts with the universities of Utrecht and Leiden (see **Heereboord, Adriaan; Regius, Henricus**; and **Voetius, Gysbertus**). In his farewell letter to Brasset, Descartes speaks of his regret about exchanging what must have been for both a second fatherland for "a country of bears" where he must live amid "rocks and ice" (AT V 349–50, CSMK 375–76).

See also Heereboord, Adriaan; Regius, Henricus; Voetius, Gysbertus

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THEO VERBEEK

BRÉGY, NICOLAS LÉONOR FLESSELLES DE (CA.1615–1689)

Brégy was born the eldest son of a president of the *chambre des comptes*. In 1637 he became councilor in the Parlement of Paris and in 1644 *conseiller du roi*. In 1645 he was sent on missions to Poland and Sweden, where **Queen Christina** appointed him *capitaine des gardes*. In March 1649, he was to join a French embassy to Constantinople, but he returned to France (December 1649), took service in the army, and eventually became lieutenant general (1655). Nothing is known about his later years except that he died November 22, 1689. His wife Charlotte de Chazans (1619–93) was known as a poetess. During the short period that Descartes and Brégy were together in Sweden they became friends (AT V 454–55). Descartes wrote Brégy after the latter left Sweden (AT V 455–57). To prevent his letter from being lost in the mail, he included a ballet to be performed the next evening. This has led some to believe that Descartes wrote a ballet. However, the ballet actually performed in Stockholm on December 9, 1649, was a German translation (by Freinsheim) of a French original by Hélié Poirier: *Die Überwundene Liebe* (Love defeated). On January 15, 1650, Descartes wrote again, complaining that during the Swedish winter "human thoughts freeze as easily as water," and

announcing that he will not wait for Brégy's return (expected in March) to go back (AT V 467, CSMK 383).

See also Christina, Queen of Sweden

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THEO VERBEEK

BUITENDYCK (DATES UNKNOWN)

In his edition of Descartes' **correspondence**, **Clerselier** identifies the addressee of a letter mainly on the *Meditations* (AT IV 62–65, CSMK 229–30) as a “Mr Buitendyck.” According to Adam and Tannery (AT), this should be Gosuinus (Van) Buitendyck (ca.1585–1661), a minister and curator of the Latin School at Dordrecht. However, in the first, albeit partial, publication of the letter by Tobias Andreae (1604–76), the addressee is qualified as *iuvenis ornatissimus* – a title given to students. So the addressee of Descartes' letter should be someone who was student between 1642 and 1650. This rules out Gosuinus. The most serious candidate is Petrus Buitendyck who, on February 6, 1644, at nineteen years old, enrolled as a student of theology at Leiden. He is probably the same Petrus Buitendyck who again enrolled as a theology student at Leiden on November 27, 1645, at twenty years old – this time described as being from Dordrecht and the son of Gosuinus, the minister. The same Petrus presumably pops up again as a student of theology at Franeker in 1647. A less likely candidate is Samuel à Buittendich from Dordrecht, who on June 21, 1647, at the age of twenty, enrolled at Leiden and is probably Petrus's younger brother – less likely because his reference would be the *Principles* (1644) rather than the *Meditations* (1641–42). However, there is no absolute certainty.

Little is known about Petrus's later career, except that in 1658 he became minister in Nieuw-Beijerland (a small village in South-Holland). Descartes' letter, which, if the addressee is Petrus, should be dated 1644 or later, provides an answer to three questions: whether it is allowed to **doubt** the **existence** of **God**, whether it is evil to suppose something false with respect to God, and whether the soul of **animals** consists in **motion**. In his answer, Descartes makes a few restrictions that are not found elsewhere. It is permitted to doubt the existence of God, that is, not to be certain of it, as long as this “doubt” is purely intellectual. And, of course, we must not suppose

anything false about God, but an evil genius (which is the real object of the question) is not the true God but an idol. Instead of identifying the animal soul with motion, Descartes would rather side with scripture (Deut 12:23) and say that it resides in the animals' blood.

See also Animal, Doubt, Existence, God

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THEO VERBEEK

BURMAN, FRANS (FRANCISCUS) (1628–1679)

Although there is no absolute certainty about the identity of the interviewer in the so-called *Conversation with Burman*, it was probably Frans Burman, who enrolled at Leiden University in 1643 to study theology. In 1650 he became minister of the Dutch Church at Hanau (Germany); in 1661, deputy dean of the Leiden *Statencollege* (a theological college for bursars of the States of Holland); and in 1662, professor of theology at Utrecht University. In theology, Burman was a follower of Johannes Coccejus (1603–69), one of the fathers of Covenant theology. This is basically a theology of history (with eschatological overtones) rather than a dogmatic, and philosophically articulated, system. As a result, it proved to be more compatible with **Cartesianism**, also because it allowed a clear demarcation between philosophical and theological spheres (see **Calvinism**). Burman was among the first to give it a more systematic form. This alone would have been enough to involve him in a controversy with the Voetians (see **Voetius**, **Gysbertus**); the fact that he was also known as being sympathetic with Cartesian **philosophy** made it definitely worse. The controversy focused on two points: the sanctification of the Sabbath (on which the Coccejans were rather relaxed) and the nature of the human **mind**, more particularly the question whether children in the womb can think and therefore have sinful thoughts – according to Burman's adversaries this would be the logical consequence of his Cartesianism, but it would contradict the Gospel, which speaks of “children not yet born, neither having done any good or evil” (Rom 9:11). Although he had never made such a claim, Burman admitted the possibility and managed to find an alternative interpretation of that text.

Burman's interest in **philosophy** presumably explains why, as a young student, he was introduced to Descartes, possibly by his professor of theology and future father-in-law Abraham Heidanus (1597–1678), who was a friend of Descartes. In any case, on April 16, 1648, he traveled to Egmond and interviewed Descartes on various questions. It is not known whether other people were present as well or whether this was the first (or the only) time Descartes and Burman met. The text, copied by **Johannes Clauberg** a few days later (April 20) in Amsterdam, shows that Burman had made a close study of Descartes' works.

See also Cartesianism; Calvinism; Clauberg, Johannes; *Conversation with Burman*; Voetius, Gysbertus

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THEO VERBEEK

CALVINISM

Calvinism is the Protestant theological tradition that goes back to Jean Calvin (1509–64). Calvinism presents itself both as a more radical version of the theology of Martin Luther (1483–1546) and as a reaction to the “Radical Reformation” of the Anabaptists. In his theology, Calvin teaches the total depravity of man, unconditional predestination (man can do nothing to secure salvation), limited atonement (the work of redemption is meant for the elect only), irresistible grace, and perseverance of the saints (once saved, always saved). Against the Radical Reformation, Calvinism reintroduced a certain hierarchical structure and an emphasis on the “scientific” (philological, historical, and philosophical) aspects of theology. Although, therefore, human **reason** should be aware of its inherent limitations (a consequence of the Fall), it would play a legitimate role in the interpretation of scripture.

The relation that Calvinism bears to Descartes’ philosophy is complex. The first confrontation between Calvinist theology and Cartesian **philosophy** took place in the United Provinces barely twenty years after the Synod of Dordrecht (1619) made an end to the controversy between Remonstrants and Contra-Remonstrants. Remonstrants believed that, as far as predestination is concerned, the testimony of scripture was inconclusive, so it should be a free issue. Contra-Remonstrants (whose view the Synod proclaimed to be the orthodox view) found the question too important to be left undecided and believed that on the basis of scripture and with the help of philosophy and logic the conclusion that there is unconditional predestination was inevitable. As a result, orthodox theology came to depend on **Scholasticism**. Moreover, the second article of the *Dutch Confession* stipulates that, although the best way to know **God** is by reading scripture, God’s power and will can to a certain extent be known from nature. Finally, even though in this view **reason** is a gift of God, one should not rely too much on it and always confront its results with the evidence of the senses and, in case of a conflict with biblical evidence, be content with what was called “learned ignorance.”

By openly rejecting the Scholastic tradition, by breaking with common sense through systematic **doubt**, and by emphasizing the power of reason over and against the senses, Cartesian philosophy constituted an immediate threat to Orthodox theology (see **Voetius**, **Gysbertus**). Moreover, Descartes insists upon using one’s own mental resources to discover the truth and turning away from books and authorities of the past. He also attempts to prove God’s existence on the basis of the **idea** of a supremely perfect being. Both of these features of his philosophy were seen as leading to “enthusiasm” (the view that man has a direct relation to God without the mediation of the church), which characterized the Radical Reformation, and as promoting atheism – all the would-be atheist had to do was to deny that he found the idea of God in himself.

However, there were many young Calvinist theologians (**Burman**, Wittich) and philosophers (**Clauberg**, Johannes de Raey) who did not see any contradiction

between Cartesian philosophy and orthodox faith. Adopting the theology of Johannes Coccejus (1603–69) they separated philosophy and theology, philosophy being concerned in their view with knowing and explaining the facts of nature and theology with evolving the story of God’s providential dealings with mankind, expressing themselves more particularly through a series of covenants (with Adam, Abraham, Moses, and David) culminating with the New Covenant and the announcement of the Kingdom of God. They totally rejected the idea that scripture could teach us anything about nature; on the contrary, they believed that the Holy Ghost preferred the language of the vulgar. So if scripture claims that at a certain point “the Sun stood still in the midst of heaven” (Joshua 10:13), the meaning is not that normally the Sun moves but that there was a certain effect (the day lasted longer) that most ordinary people would explain by supposing that the Sun stood still. In sum, insofar as scripture contains any claim concerning natural things, no specific meaning should be attached to them. This relaxed attitude made it possible to appreciate not only Cartesian **physics** but, to a certain extent, even Cartesian **metaphysics** and to hail Descartes’ philosophy as a contribution to the Reformation, in particular his break with Scholastic philosophy, which by then was seen as a last vestige of popish influence.

See also Burman, Frans; Faith, Religious; God; Philosophy; Reason; Scholasticism; Voetius, Gysbertus

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THEO VERBEEK

CARCAVI, PIERRE DE (CA.1600–1684)

Carcavi was born in Lyon, the son of Jean de Carcavi, receiver-general of the districts of Languedoc, Guyenne, and Lyonnais. There are no records of university education, but evidently he studied law and early on acquired a strong interest in **mathematics**. In 1632, through the help of his father, he was made *conseiller* to the Parlement of Toulouse, where he first met **Pierre de Fermat**. They remained close

friends throughout their lives, and Fermat later sent him copies of his mathematical texts. Carcavi was encouraged by Fermat to write to other mathematicians such as Descartes, **Roberval**, and Torricelli, and he later developed an extensive correspondence network. In 1636, with money from his father, he bought the office of *conseiller* to the Grand Conseil and moved to Paris.

Paris provided Carcavi with a fertile intellectual environment. He developed close ties to Roberval, as well as to **Mersenne** and the young **Blaise Pascal**, and later became a member of the Académie de Montmor. In 1648 his career suffered a temporary setback, when financial difficulties of his father forced him to sell his position at the Grand Conseil. For a while he traded books before entering the service of Duc de Liancourt. Through a stroke of luck, another of Roger du Plessis's protégés, the Abbé Amable de Bourzéis, introduced him to Colbert who was seeking someone to catalog Cardinal Mazarin's library. After thus demonstrating his aptitude, Carcavi was appointed custodian of the Royal Library by Colbert in 1663. He held this post for twenty years and played a decisive role in enriching the library's holdings.

Carcavi's relations to Descartes were seldom straightforward. After the death of Mersenne in 1648, he offered his extensive correspondence to Descartes. The following year, Carcavi informed Descartes of Roberval's objections to his *Geometry*. Descartes replied with a refutation of his claims. When Carcavi publicly defended Roberval, Descartes severed all ties with him. He died in Paris April 1684.

See also Geometry; Mersenne, Marin; Roberval, Gilles Personne de

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PHILIP BEELEY

CARTESIANISM

The great historian of ideas, Arthur Lovejoy (1940), referred to ideas as "potent," "stubborn," and "migratory," making the study of ideas and their development complicated, nonlinear, and unpredictable. Philosophic systems are a complex body of interrelated ideas that can engender dynamic intellectual movements. The movements sometimes ebb and flow and sometimes exert themselves in unexpected ways on human thought

and life. The more a philosophic system is developed, the more likely it is to become distant from the specific doctrines and formulations of its originator. Cartesianism is no exception. During the second half of the seventeenth century, the philosophy originated by René Descartes (1596–1650) dominated the intellectual life of France and beyond. It was a period that saw the most dynamic challenges, defenses, debates, and developments of Descartes’ ideas. While the legacy of the Cartesian **philosophy** remains today, a sense of its once vibrant and dynamic power has given way to popularized caricatures.

Cartesianism itself is not a clearly defined system of thought, though its proponents characteristically defend Descartes’ **substance-mode** ontology, his view that **thought** is the **essence** of **mind** and **extension** the essence of **body**, and his view that **ideas** represent objects external to the mind in a nonresembling way, to name just a few of his main doctrines. Descartes is famous for having argued that the starting point of all certain **knowledge** is the *cogito*, “I think, therefore I am,” and that the mind and body are really distinct. It would seem that any genuine Cartesian should at least espouse these views. However, with the exception of Descartes’ view that thought is the essence of mind, there seems to be no single view, argument, or doctrine that escapes rejection at the hands of a genuine Cartesian.

Not much history is required to see that there is no single doctrine or set of doctrines whose interpretation yields a unique identification of Cartesianism. The classic treatment of the history of Cartesianism is Francisque Bouillier’s *Histoire de la philosophie cartésienne* (1868). Bouillier provides a rich and detailed account beginning with Descartes and **Bacon** in the early seventeenth century being struck by the emptiness and sterility of the philosophy taught in the schools. According to Bouillier, although Bacon and Descartes differed on the nature of **method**, they both saw method as the key if philosophy is to have a practical end and serve to improve the conditions of human existence (1868, 1:57). Bouillier notes throughout his history of Cartesianism the doctrinal disagreements, the revisions of core ideas and arguments, and the debates over the true doctrines, and he looks to the Cartesian method as the unifying issue in the history.

Yet, genuine Cartesians disagreed over the proper method of natural philosophy, which calls into question the unity of method as the defining feature of Cartesianism. For example, the Cartesian **Robert Desgabets** (1610–78) rejected Descartes’ method of **doubt**. Moreover, attempts to identify core ideas or doctrines have met with a similar problematic end. Richard Watson’s *Breakdown of Cartesian Metaphysics* (1987) tells the history of Cartesianism as a failure to provide a complete and coherent metaphysical system. Specifically, Watson argues that Cartesians failed to explain how two unlike substances such as mind and matter could causally interact, and how mind could possibly know matter. Watson describes “orthodox Cartesians” as the most faithful adherents to Descartes’ doctrines concerning mind-body **dualism** and interactionism typified by the rejection of occasionalist solutions to these problems. However, following the orthodox line of Cartesianism provides neither a

comprehensive nor a singular account, and its culmination in the critique of skeptic **Simon Foucher** (1644–96) offers just one of the many historical and philosophical developments of Cartesianism. Attempts to define Cartesianism by any individual doctrine or set of doctrines, therefore, unavoidably fail to capture what constituted Cartesianism during the latter half of the seventeenth century.

Other histories of Cartesianism have focused on formative themes such as skepticism, mechanism, the elimination of final causes in **physics**, the nature of ideas, dualism, and rationalism versus empiricism, or materialism versus idealism. Richard Popkin focuses on skepticism in his explanation of Cartesianism, explaining that it was the skeptical crisis set in motion by the Reformation that led to the set of responses found among the Cartesians. But, here again, no single response typifies Cartesianism. One finds various skeptical and nonskeptical sources of Cartesian doubt, as well as skeptical and antiskeptical impacts of Cartesianism on the seventeenth and eighteenth centuries. Another theme, Descartes' elimination of final causes in physics and the pursuit of mechanistic accounts of physical phenomena and animal behavior, led to ideas developed by the Cartesians **Jacques Rohault** (1620–72) and **Pierre-Sylvain Régis** (1632–1707) (Mouy 1934). Despite Descartes' dualism, the influence of Cartesianism on eighteenth-century materialism has also been noted (Rosenfield 1968). The putative incoherence of Descartes' substance dualism has been seen as the source of the grand revisions in the Cartesianism of **Géraud de Cordemoy** (1622–84) and Belgian philosopher **Arnold Geulincx** (1624–69). As the problematic story goes, this incoherence culminates in the occasionalism articulated by **Nicolas Malebranche** (1638–1715) (Watson 1966, 1987) (see **cause**). The two most famous metaphysical systems of the seventeenth century were developed in reaction to Descartes, by the great post-Cartesians **Gottfried Wilhelm Leibniz** (1646–1716) and **Baruch Spinoza** (1632–77) (Woolhouse 1993). The Cartesian debates over the nature of ideas engaged in by Cartesians such as **Antoine Arnauld** (1616–98), Pierre Nicole (1625–95), and Malebranche have drawn attention to the inherent difficulty of explaining in representationalist terms how ideas of things can be known to present the things themselves to the mind, as well as the implausibility of reliance upon innate ideas (see Nadler 1989, 1992). Still other histories have focused on larger themes, such as rationalism and empiricism, or materialism and idealism, to tell the history of Cartesianism. For example, Tad Schmaltz (2002, 10) argues that at the heart of Cartesianism is the doctrine that “the essence of body consists in extension and that the essence of mind consists in thought.” He sees the “radical Cartesians” **Desgabets** and **Régis** as developing a Cartesian realism in contrast to the idealism seen in Malebranche and his followers. But even the core doctrines that the radical Cartesians develop exist on a continuum between rationalism and empiricism and materialism and idealism. As Thomas Lennon and Patricia Easton (1992, 1) have observed, despite the fundamentality of the doctrine of matter, which entails Descartes' rejection of **atoms** and the void (see

vacuum), the Cartesian Cordemoy was an atomist. Thus, we return to the observation that no single doctrine or set of doctrines serves to identify Cartesianism.

The rationalism so often viewed today as an inherent feature of Cartesian philosophy is not only separable, as is seen in the writings of Desgabets and Régis, but most often misrepresented, as is seen in the writings of **Antoine Le Grand**. Desgabets and Régis rejected the possibility of pure intellection, defended the sensory foundation of all knowledge, and provided an experience-based model of reasoning. Even Le Grand, who adopted an essentially rationalist standard of true knowledge, nonetheless argued that experience and experimentation are indispensable in the search for **truth**. For each of these figures, Descartes' thesis of the free creation of essences and the **eternal truths** meant that truth is something revealed by the effects of nature. Logical truths, along with all the other so-called eternal truths, were thought to be the *consequences* of the nature of created things. Although they differed with respect to the significance and specific applications of Descartes' insight, they agreed that the effects of nature can only be known by experience, and so experience came to occupy an important if not integral place in their development of the Cartesian epistemology. Moreover, the French theologian and Cartesian Pierre Poiret (1646–1719) believed that Descartes' doctrine of the creation of the eternal truths entailed that truth is dependent and arbitrary, and thus inherently irrational (something Descartes did not hold). Thus, Poiret was led to develop Cartesianism in the direction of mysticism.

The myth of Cartesian rationalism, therefore, is twofold. First, the traditional characterization of Cartesian rationalism as holding that **reason** is the source of all knowledge, and that first principles and their **deductions** are known independently of the evidence of the senses and experience, is false (see **sensation**). Malebranche famously argues against the doctrine of innate ideas. Le Grand did not believe that rational deductions could be known independently of experience. Desgabets and Régis thought that the truths of **mathematics** were grounded in the effects of nature. Once established, these truths are unchanging and could be known by reason, but there is no pure intellection or thought independent of the senses. Second, the traditional portrayal of Cartesianism as an inherently rationalist philosophy is false since some of its most ardent defenders such as Desgabets and Régis developed and defended the philosophy along lines that bear at times a closer resemblance to an empiricist epistemology than a rationalist one. There are many “isms” that are incorporated into the Cartesian philosophy, and even Descartes' writings are fraught with interpretive difficulties, as the body of Descartes scholarship demonstrates.

The beauty of Descartes' philosophy, as with any rich philosophical system, is as much a product of its complexity as its comprehensiveness and orderliness. Despite even the most rationalist tendencies found in Descartes' writings, we have seen some of his own views pointed in multiple nonrationalist directions. Perhaps the conclusion to be reached is that the open-endedness of Cartesian principles provides us

with a complex and dynamic system of ideas that lends itself to multifaceted analyses. Rather than closed and static, Cartesianism is historically open-ended and dynamic.

See also Arnauld, Antoine; Cause; Cordemoy, Géraud de; Desgabets, Robert; Doubt; Dualism; Eternal Truth; Foucher, Simon; Geulincx, Arnold; Human Being; Idea; Le Grand, Antoine; Malebranche, Nicolas; Method; Régis, Pierre-Sylvain; Reason; Rohault, Jacques

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PATRICIA EASTON

CATERUS, JOHANNES (JOHAN KATER OR DE KATER) (CA. 1590–1655)

Johannes Kater (better known under his Latinized name Caterus) was probably born in Haarlem, around 1590. He enrolled at Leuven (Louvain) in 1620 to study theology. He returned to Holland as a secular priest, reporting himself as such (conforming to

regulations) to the Amsterdam magistrate in January 1629. In 1632 he was elected to the Haarlem Chapter on condition of obtaining a doctorate in theology. Accordingly, he returned to Louvain in 1634 and obtained degrees in law and theology. In 1638 he became “archpriest” (some sort of dean) of Alkmaar to supervise all pastoral activities in the northern part of the Province of Holland. He was praised for his learning and piety as well as his zeal on behalf of the Catholic religion, which brought him several times in conflict with the civil authorities. Probably at the suggestion of two Haarlem priests, Joan Albert Bannius (1597–1644) and Augustinus Alstenius Bloemaert (ca. 1585–1659), two friends of Descartes, who were also members of the Haarlem Chapter, Caterus became the author of the First Objections (see AT III 267, CSMK 164). There is no evidence that at that point Descartes knew Caterus personally, although there is nothing to exclude that possibility either. In any case, Descartes probably knew him somewhat later, because after 1642 he lived almost permanently at Egmond, which is within walking distance (eight kilometers) of Alkmaar.

In the First Objections, Caterus concentrates on Descartes’ proofs of the **existence of God**, starting with the **cosmological argument** and the attendant notion of objective being (see **being, formal versus objective**). According to Caterus, objective being is the thing insofar as it is thought or perceived, not a reality caused by that thing – an “**extrinsic denomination** that adds nothing to the thing itself” (AT VII 92, CSM II 66–67). As a result, the causal principle does not apply. As for the second cosmological argument for God’s existence, which proceeds from the existence of the meditator who possesses the **idea** of God, Caterus agrees that if a thing is the **cause** of itself in the positive sense of the word, that is, if it is truly and fully the cause of itself, it would necessarily give itself all the perfections of which it has an idea. However, according to him, God is only the **cause** of himself insofar as there is not another thing that causes him to be. As a result, the second proof is invalid (AT VII 95, CSM II 68). Finally, although Caterus agrees with Descartes’ rule for truth, that whatever we conceive clearly and distinctly is true, he has some deep objections to Descartes’ **ontological argument** since, according to him, as finite beings we lack a clear and distinct idea of God, who is infinite. Indeed, that is the very reason we need to prove his existence. But even if we had such an idea, the proof would still be invalid because all it shows is that, insofar as we do conceive God, we conceive him as necessarily existing. In other words, it shows only that *if* there is a God, then he necessarily exists (AT VII 99, CSM II 72). In his replies to “the learned theologian,” Descartes covers new ground only insofar as he explicitly admits that when referring to God as being the cause of himself he does want it to be understood in the sense of a positive causality: God is truly and fully the cause of himself – a point taken up by **Antoine Arnauld** and various Calvinist theologians (e.g., Revius, Stuart) (AT VII 108–9, CSM II 78–79). As for Caterus’s objection that we cannot fathom God’s infinity, Descartes draws a distinction between grasping and understanding: although God cannot be “grasped” (*capi*) by the human understanding, it is possible to “know”

him distinctly – just as we cannot actually see the infinity of the ocean but are still somehow aware of it (AT VII 113, CSM II 81). Moreover, the existence we attribute to God is not simply possible, as in the case of a contingent being, but necessary – a unique **attribute** that can be ascribed only to God (AT VII 116–17, CSM II 83–84).

The exchange between Descartes and Caterus is the only one that was solicited and, presumably, controlled by Descartes himself. In fact, Caterus did exactly what Descartes expected all objectors to do (cf. AT II 622) – namely, to acknowledge the novelty of his ideas by making a few critical remarks, while at the same time confirm their orthodoxy on a more fundamental level.

See also Being, Formal versus Objective; Cause; Cosmological Argument; Extrinsic Denomination; God; Infinite versus Indefinite; *Objections and Replies*; Ontological Argument

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THEO VERBEEK

CAUSE

The notion of causation is central to Descartes’ **metaphysics** and **physics**. In his metaphysics, Descartes requires a specific sort of causal principle to support his claim in the Third Meditation that **God** must be the cause of his **idea** of God as infinite **substance**. In the discussion of the foundations of his physics in the *Principles of Philosophy* (1644), moreover, Descartes appeals to the distinction between God as the “universal

and primary cause” of **motion** and the **laws of nature** as “secondary and particular causes” of it.

The context for Descartes’ theory of causation is provided by the Aristotelian views that were dominant in early modern **Scholasticism**. In the second book of his *Physics*, Aristotle explicates four different kinds of “cause” (*aition*): material, formal, efficient, and final. The material cause is that out of which something comes to be, the formal cause the form of that which comes to be, the efficient cause the primary source of change, and the final cause that for the sake of which there is a change. For instance, in the case of a bronze statue, the bronze is the material cause, the shape of the statue the formal cause, the sculptor the efficient cause, and the goal of the sculptor in producing the statue the final cause.

In early modern Scholasticism, there is an increasing emphasis on the priority of efficient causes in an account of causation (for this point, see Carraud 2002, ch. 1; Schmaltz 2008, 29–36). Thus, the early modern Scholastic **Francisco Suárez** (1967, I 384) claimed that efficient causes best reflect his official **definition** of a cause as that which serves “as a *per se* principle from which being flows into another.” Material and formal causes fit this definition imperfectly since they do not produce an external effect (“another”) but rather are “intrinsic causes” that constitute the effect. Though the final cause is similar to the efficient cause in being an “extrinsic cause” that produces an external effect, it nonetheless is able to “flow being into another” only by influencing the action of a particular kind of efficient cause, namely, an intellectual agent that cognizes the goal of its action. Only in the case of an efficient cause do we have something that directly produces some external being, whether with the assistance of other causes (as in the case of all actions of “secondary” efficient causes, which depend on God’s “*concursus*” as “primary cause”), or entirely by itself (as when God acts alone as a primary cause in creating and conserving creatures) (see **concurrency versus conservation, divine**).

Whereas Suárez was willing to appeal to God as a final cause in nature, however, Descartes insists that any such appeal is precluded by the fact that divine purposes are entirely hidden from us. It is because of divine inscrutability that we are to consider God only “as the efficient cause of all things” (AT VIIIA 16, CSM I 202). Moreover, Descartes indicates the primacy of efficient causation when he emphasizes that his (Scholastic) principle in the Third Meditation – that a cause must contain what is in its effect “formally or eminently” – applies only to the “efficient and total cause” (AT VII 40, CSM II 28) (see **containment, eminent versus formal**).

Even though it is sometimes said that Descartes reduces all causes to efficient causes, this is not technically correct. For instance, when **Antoine Arnauld** takes exception to the suggestion in the *Meditations* that God is a cause of himself, or *causa sui*, Descartes insists that God is not an efficient cause of his own **existence** but merely something like a formal cause, where the “form” in this case is God’s nature

as a supremely perfect being (see AT VII 235–45, CSM II 164–71 and Schmaltz 2008, 59–61). Descartes also does not explicitly rule out the appeal to final causation in the case of the intentional action of finite **minds** and, indeed, seems to endorse a teleological notion of the human will in claiming that this faculty is “drawn voluntarily and freely (for that is the essence of the will), but nevertheless inevitably, toward a clearly known good” (AT VII 166, CSM II 117).

Nonetheless, Descartes indicates clearly enough that the only sort of causation to be invoked in physics is efficient causation. In the discussion in his physics of the efficient cause of motion (i.e., the separation of the parts of extended substance), Descartes assigns to God the role of being the “universal and primary cause” responsible for “all motions in the world” (AT VIIIA 61, CSM I 240). He further claims that God acts as a primary cause in creating and conserving a particular total “**quantity of motion**” (see **conservation of motion, principle of**). Descartes’ account of God’s activity as primary cause is linked to his claim that there is only a “distinction of reason” between conservation and creation. Though this claim is sometimes read as indicating that God conserves the material world by “re-creating” it anew at each moment, it seems fairly clear that Descartes accepts the position, prominent in late Scholasticism, that God’s act of conservation is identical to his initial act of creation (see **concurrence versus conservation, divine**).

Descartes distinguishes God’s activity of conserving the total quantity of motion from the activity of “secondary and particular causes,” which is responsible for the fact that “singular parts of matter acquire motion they did not have previously” (AT VIIIA 61, CSM I 240). An initially odd feature of his account of secondary causes is that he identifies them with “rules or laws of nature” (AT VIIIA 62, CSM I 240). From a Humean perspective, such rules or laws would seem to be mere empirical generalizations, hardly the sort of thing that could serve as a cause. However, one suggestion is that causal power is to be attributed to the ontological ground of the laws rather than to the laws themselves.

Given the constraints of Descartes’ ontology, the main candidates for such a ground would seem to be God and **bodies** as extended things. It is clear that Descartes takes God to be at least one of the grounds of the laws, since the proofs that he provides for the laws appeal to “the immutability and simplicity of the operation by which God conserves motion in matter” (AT VIIIA 63, CSM I 242). However, there might seem to be good reason for him to draw the stronger occasionalist conclusion that God is the sole efficient cause of changes in motion due to bodily collisions. After all, his official position is that the nature of body consists in **extension** alone. Given that extension is merely passive, bodies cannot literally possess the forces that Descartes seems to attribute to them (for the occasionalist reading of Descartes’ physics, see Hatfield 1979; Garber 1992, ch. 8) (see **force and determination**). However, there is an attempt in the literature to explain the forces of bodies in terms not of their geometrical and kinematic features but rather of their duration. Descartes’ first law

of nature indicates that this duration includes a tendency to remain in the same state, and Descartes explicitly claims that this law indicates the source of the various quantifiable forces to which his third law of nature appeals (AT VIIIA 66, CSM I 243; cf. Gueroult 1980; Gabbey 1980; Schmaltz 2008, 116–21).

Even if Descartes can make room for genuine bodily causes in his physics, however, he still seems to confront difficulties with respect to mind-body interaction. In the literature, these difficulties are often linked to what Bernard Williams has called “the scandal of Cartesian interactionism,” which scandal derives from the fact that “there is something deeply mysterious about the interaction which Descartes’ theory required between two items of totally disparate natures, the immaterial soul, and the [pineal] gland or any other part of an extended body” (Williams 1978, 287). The assumption here is that Descartes requires a kind of likeness between cause and effect that is missing in the case of objects as heterogeneous in nature as Descartes took mind and body to be (see, e.g., Radner 1985; Baker and Morris 1996, 138–62).

This problem of heterogeneity is commonly assumed to result from Descartes’ principle that a cause must contain what is in its effect formally or eminently. Recently, however, apologists for Descartes have claimed that this principle is perfectly consistent with his own commitment to mind-body interaction (see Richardson 1982; Loeb 1985; O’Neill 1987; Schmaltz 1992). For one thing, the inclusion of eminent containment allows for heterogeneous interaction in cases where the cause is “nobler” than its effect. Given the suggestion in Descartes that an indivisible mind is nobler than a divisible body, his principle at least does not automatically preclude the action of mind on body. There still would seem to be a problem with the action of the less noble body on the nobler mind. However, Descartes emphasizes that his principle applies only to efficient causes that are “total,” which allows him to hold that bodily causes of mental states are merely “partial.” Indeed, this sort of partial causation seems to be indicated by his claim in the *Comments on a Certain Broadsheet* (1648) that motions in the brain trigger the production of sensory ideas by an innate mental faculty (AT VIIIB 358–59, CSM I 304; see Schmaltz 2008, 149–57).

Some new problems with interaction are indicated in the famous **correspondence** between Descartes and **Princess Elisabeth**. In her initial letter to Descartes, Elisabeth asks how an immaterial soul can move a body, given that such motion can occur only by means of contact action. Although it is sometimes claimed that the heterogeneity problem lies behind this worry, Elisabeth seems to be raising a difficulty that applies specifically to the case of the action of mind on body. In his response, Descartes admits that he has said “almost nothing” to this point about the fact that the human soul, “being united to a body, ... can act and be acted on by it” (AT III 664, CSMK 218). He then attempts to explicate this fact in terms of a “**primitive notion**” of soul-body union that is distinct from primitive notions common to all beings (such as being, number, and duration), to all bodies (extension and, with it, **shape** and motion), and to all souls (**thought** and, with it, **perceptions** of the

intellect and inclinations of the will). He emphasizes in particular that the primitive notion of the union allows for the conception of the distinctive sort of causation that occurs when the soul moves the body, a kind of causation that cannot be understood in terms of the matter in which one body moves another by contact action.

In order to illustrate this distinctive sort of interaction, Descartes appeals to the Scholastic account of heaviness in terms of the “**real quality**” of weight (*pesanteur*) (see **gravity**). On that account, this quality consists simply in “the force to move the body in which it is toward the center of the earth,” and even though the quality is supposed to be something distinct from body, “we have no difficulty in conceiving how it moves this body or how it is joined to it” (AT III 667, CSMK 2 19). Elisabeth protested that the appeal to the action of this quality in order to explain the action of the soul on body is an **explanation** of the obscure in terms of something even more obscure. However, the point of Descartes’ **analogy** is to show that the notion of the union allows for the conception of the action of the soul on body, despite the fact that it is really distinct from body. The Scholastics misapplied this notion in the case of the real quality of heaviness, but for Descartes it is properly applied to the case of the action of our soul on the body to which it is united (see Garber 1983b).

There is a further issue concerning the action of mind on body that arises from Descartes’ principle of the conservation of motion. In some of his discussions of Cartesian interaction, **Gottfried Wilhelm Leibniz** claims that Descartes was led by this principle to deny that finite minds can add to the quantity of motion in the universe. According to Leibniz (1985, 156), Descartes held instead that the mind changes only the direction of bodily motions, “much as a rider, though giving no force to the horse he mounts, nevertheless controls it by guiding that force in any direction it pleases.” Recently, one commentator has argued that Leibniz “was basically right both on the historical question of what Descartes meant to say about conservation and change of direction and on the philosophical question of why he had to mean this” (McLaughlin 1993, 157). However, there is the competing view that it is open to Descartes to answer “Leibniz’s attack on interactionism by simply denying that the conservation laws hold for animate bodies” (Garber 1983a, 116; cf. Smith 1902, 83 n.2, and Remnant 1979). The evidence seems to be stacked against the claim that Descartes in fact accepted the change-of-direction account of voluntary motion; after all, he frequently refers to the “force” of the human soul to move the **pineal gland**, where what is at issue is the production of new motion and not merely the determination of direction. Nevertheless, the admission that finite minds can add new motion seems to introduce complications for Descartes’ position that when God acts as a primary cause of motion, he merely conserves by means of his ordinary *concursus* the same total quantity of motion that he originally created. It seems that additions to the quantity of motion by finite minds cannot leave unaffected the constancy of God’s activity as primary cause.

The aspect of Descartes' theory of causation that seems to introduce the greatest complication, however, is his doctrine of the creation of the **eternal truths**. According to this doctrine, God's wholly indifferent will is the efficient cause of eternal truths. On a common interpretation, this doctrine has universal scope, so that even the truth that God exists is subject to God's indifferent will (see, e.g., Frankfurt 1977 and Bennett 1994). However, in his exchange with Arnauld concerning the notion of God as *causa sui*, Descartes explicitly denies that God is the efficient cause of his own existence. This denial is reflected in his discussion of the causal axiom that "no thing exists of which it cannot be asked what is the cause why it exists." Anticipating the objection that no cause is required in the case of God's existence, Descartes notes that "this can be asked even of God himself, not because he needs any cause in order to exist, but because the immensity of his nature is the cause or reason [*causa sive ratio*] why he needs no cause to exist" (AT VII 164–65, CSM II 116). The implication here is that though the eternal truth that God exists has a reason in the immensity of the divine nature, this nature does not provide the sort of efficient causal explanation for this truth that is required in the case of all created eternal truths (for the view that God allows for uncreated truths, see Wells 1982 and Schmaltz 2011).

Moreover, the fact that the eternal truth that God exists requires an ultimate reason serves to distinguish it from created eternal truths. For Descartes notes at one point that "it is repugnant that the will of God not be indifferent from eternity to all that has been made or will be made" since "there is not any priority or order, or nature, or 'reasoned reason' [*ratione rationcinata*], as it is called, such that this idea of good impels God to choose one thing rather than another" (AT VII 431–32, CSM II 291). Given the essential indifference of divine efficient causal activity, there can be no preexisting ideas that provide reasons for God's creation of the eternal truths. Though Descartes sometimes allows that God may have purposes that are hidden from us, this implication requires that such purposes must be the product of indifferent divine creation and thus cannot condition it (see Lennon 1998, 336). Whereas the divine nature provides the reason for God's existence, there is nothing that can provide a reason for what God creates, including created eternal truths.

There is some question whether the result of Descartes' doctrine of the creation of eternal truths that God can have no preexisting reasons for action is consistent with his containment axiom. The problem here is that the axiom that a "total and efficient" cause must contain what is in its effect either formally or eminently seems to require that God contain what he creates eminently. In the case of finite minds, what is eminently contained provides some basis for the causation of the effect. But Descartes makes clear that there can be no idea that conditions divine creation. Given this position, God contains not the reality of his effects (in contrast to the case of finite minds) but rather a power that is able to produce the reality of these effects entirely *ex nihilo* (a power totally lacking in finite minds).

See also Body; Concurrence versus Conservation, Divine; Conservation of Motion, Principle of; Containment, Eminent versus Formal; Eternal Truth; Force and Determination; God; Human Being; Law of Nature; Metaphysics; Physics; Primitive Notion; Scholasticism; Suárez, Francisco

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TAD M. SCHMALTZ

CAVENDISH, MARGARET (DUCHESS OF NEWCASTLE) (1623–1673)

The Duchess of Newcastle was a prolific authoress whose writings include several works on philosophical subjects. Her interest in natural philosophy was encouraged by her husband, **William Cavendish**, Duke of Newcastle (formerly Marquess), and his brother, Sir Charles Cavendish. Through the Cavendish circle she met both Descartes and **Hobbes**, although she denied having any significant contact with either. She was a beneficiary of the Cartesian turn in philosophy to the extent that she repudiated traditional book learning and took the thinking self as her point of departure. Her own philosophy is, however, fundamentally opposed to **Cartesianism**, since she denied **dualism** of **mind** and **body**, proposing instead a materialist and vitalist account of nature. In her *Philosophical Letters* (1664) and her *Observations upon Experimental Philosophy* (1666), she made specific criticisms of Descartes, particularly of his dualism – for example, she questioned how an immaterial **substance** could move a solid body, and his locating the human soul in the **pineal gland**.

See also Cavendish, William; Dualism; Hobbes, Thomas; Human Being; Pineal Gland

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SARAH HUTTON

CAVENDISH, WILLIAM (MARQUESS OF NEWCASTLE) (1592–1676)

Born December 6 in Yorkshire, William Cavendish was a man of many interests and talents. He fought as a military leader for the royalists, served as adviser to Charles I and Charles II, wrote plays and poems, and founded a riding school. During the interregnum, William and his brother Charles spent several years in Paris, where they met **Hobbes**, **Gassendi**, and Descartes, among others. While in France, William married his second wife, **Margaret** (1623–73), a writer and philosopher who published works critical of mechanical **philosophy** in general and of Descartes (among others) in particular. Both Cavendish brothers corresponded with Descartes, and three letters from Descartes to the marquess have survived (AT IV 188–92, 325–30, and 568–77; CSMK 274–76, 302–4). In the second of these, Descartes remarks that the chief goal of his studies is the preservation of health, and he seconds Tiberius's claim that anyone over thirty is qualified to be his or her own physician, inasmuch as good health depends upon being attentive to one's experience of what harms or benefits one's **body** (AT IV 329–30, CSMK 275–76). In the third letter, Descartes repeats his claim from the *Discourse on Method* that **animals** are nothing more than unthinking, self-moving **machines**. He bases this on the grounds that because (according to him) **language** use is the surest sign of a thinking **mind**, and no animals use language, while even the slowest human beings do, animals must be without thoughts. It is interesting that in the *Discourse* (AT VI 59–60, CSM I 141) Descartes concluded that if we grant that animals think just as we do, then we have no more hope of an afterlife than does a fly or an ant (i.e., none); because we *do* have such a hope, it must be that they do not have minds. In his letter to Newcastle, on the other hand, he claims that if we attribute **thought** to

animals, we must thereby attribute immortal souls to them (see **soul, immortality of the**). Given (Descartes says) that the idea that oysters and sponges might have immortal souls is clearly false, it must be that they do not have minds (AT IV 576, CSMK 304). Thus, Descartes arrives at the same conclusion via two similar, but distinct, lines of implication. William Cavendish died December 25, 1676, at Welbeck Abbey.

See also Animal; Body; Cavendish, Margaret; *Discourse on Method*; Language; Mind; Soul, Immortality of the; Thought

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FRED ABLONDI

CERTAINTY

Much of the critical discussion around certainty in Descartes' work centers on the relationship between "the quest for certainty" and "the search for **truth**"; this issue is intertwined with our understanding of **clarity and distinctness**, the method of **doubt**, and the alleged Cartesian Circle (see **Circle, Cartesian**). An important prior question concerns Descartes' own conception of certainty; this is the main focus of the present entry.

Certainty for Descartes comes in degrees or levels; Descartes' technical terminology for these degrees was to some extent shared by his contemporaries, in particular the terms "moral certainty" and "metaphysical certainty." There are debates about how to understand both of these terms.

Moral certainty is sometimes treated in the literature simply as *probability*; the correctness of this identification depends in part on what conception of probability one has in mind, but note that Arnauld and Nicole (1996, 264, 270) explicitly distinguish *between* moral certainty and probability. (Probability is what the man of good sense must fall back on if moral certainty is unavailable.) It seems less potentially misleading to suggest that a morally certain proposition is one that is "beyond all *reasonable* doubt." (The courtroom flavor of this phrase is intentional: Scholastic paradigms of moral certainty tend to focus on testimony, and Descartes himself strikingly uses the image of the mental **faculties** as witnesses; see Baker 2000. Even now, American juries are often instructed to seek verdicts "beyond a reasonable doubt

and to a moral certainty.”) Moral certainty is “sufficient to regulate our behaviour, or ... measures up to the certainty we have on matters relating to the conduct of life which we never normally doubt” (AT VIII B 327, CSM I 289 n.2). Descartes’ example of “Rome is a city in Italy” (AT VIII A 327, CSM I 290) is a Scholastic staple. Such propositions are still subject to “unreasonable” (extravagant) grounds for doubt, for example, the idea that we may be dreaming (AT VI 38, CSM I 130; cf. AT VII 19, CSM II 13) or the idea of a massive coordinated conspiracy to lie (cf. AT VIII A 327, CSM I 290; Arnauld and Nicole [1996, 261] call such a conspiracy “morally impossible”; we would be “insane” and “have lost all sense” to suppose such a thing). Thus “we have a moral certainty about these things (e.g., that the stars and the earth exist), so that it seems we cannot doubt them without being extravagant; nevertheless, when it is a question of metaphysical certainty, we cannot reasonably deny that there are adequate grounds for not being entirely sure of them” (AT VI 37–38, CSM I 130).

One issue around *metaphysical certainty* concerns its relation to clear and distinct **perception**. Entangled with this is the question of whether the class of metaphysically certain propositions is homogeneous, and if not, whether we ought to speak of a third degree of certainty between moral and metaphysical certainty.

The question of the relationship between clear and distinct perception and the natural light is beyond the scope of this essay; however, it is plausible to suggest that Descartes’ characterization of what is “revealed to me by the natural light” (he cites as an example “that from the fact that I am doubting it follows that I exist”), namely, that it “cannot in any way be open to doubt,” also suffices as a characterization of what is metaphysically certain (cf. AT VII 38, CSM II 27). If this is accepted, there is a powerful case for saying at least that not all *clearly and distinctly perceived* propositions are metaphysically certain (see Markie 1979). After all, in the First Meditation, those paradigm objects of clear and distinct perception, such simple arithmetical and geometrical propositions as that $2 + 3 = 5$ and that squares have four sides, were called into doubt on the hypothesis that either **God** does not exist or he is a deceiver (AT VII 21, CSM II 14). However, there are other propositions that, though clearly and distinctly perceived, are not called into doubt even on this most extreme hypothesis. “I exist” is one such (AT VII 25, CSM II 17). Metaphysical axioms or **common notions** such as those that Descartes lists in the **Geometrical Exposition** (AT VII 164–67, CSM II 116–17) – for example, “Whatever reality or perfection there is in a thing is present either formally or eminently in its first and adequate cause” – are also metaphysically certain. The principles of syllogistic logic too surely fall into this category.

Broughton (2002, 181) argues persuasively that those clear and distinct perceptions that are metaphysically certain (she actually uses the term “absolutely certain”) are those that are “conditions of using First Meditation doubt.” This,

however, leaves the certainty status of the other clear and distinct perceptions, especially those of arithmetic and geometry, in limbo; Broughton herself treats them as *moral* certainties. One might, however, see a vital difference between the usual moral certainties, grounded in the senses and the testimony of others, on the one hand, and arithmetic and geometry, discerned by the pure **intellect**, on the other. Although the latter can be called into doubt, they can be so *only* by a “very slight and, so to speak, metaphysical reason for doubt” (AT VII 36, CSM II 25, the phrase ‘so to speak’ plausibly indicating the phrase’s Scholastic lineage), namely that God either does not exist or is a deceiver; they cannot be called into doubt by the sorts of “extravagant” hypotheses used to cast doubt on the typical cases of moral certainty, for example, that I might be dreaming, since “whether I am awake or asleep, two and three added together are five” (AT VII 20, CSM II 14).

In part on the basis of such considerations, it has been argued (e.g., by Morris 2003) that we need to identify a *third* degree of certainty, namely, “absolute certainty,” to apply to such propositions; this term does figure in the Cartesian corpus, although it is often read as equivalent to “metaphysical certainty”: “There are some matters ... which we regard as absolutely, and more than just morally, certain.... This certainty [on this reading, *unlike* metaphysical certainty] is based on a metaphysical foundation, namely that God is supremely good and in no way a deceiver.... Mathematical demonstrations have this kind of certainty” (AT VIIIA 328, CSM I 290). Once this “slight and metaphysical” reason for doubt is eliminated (per the Third Meditation), the absolutely certain may be treated *as* metaphysically certain, “for what objections can now be raised?” (AT VII 70, CSM II 48), and counts as part of *scientia*: stable **knowledge** that cannot be undermined by further reasons for doubt. (Both Broughton and Morris have developed defenses of Descartes from the charge of circularity on the basis of these distinctions.)

Thus read, both certainty and doubt are thoroughlygoingly *reason*-based enterprises: “to doubt” is to provide a reason for doubt, and certainty consists in the absence, or elimination, of the appropriate class of reasons for doubt. When Descartes is “finally compelled to admit” that there are none of his philosophical **prejudices** “about which a doubt may not properly be raised,” he adds “this is not a flippant or ill-considered conclusion, but is based on powerful and well-thought out reasons” (AT VII 21, CSM II 14–15). One implication of this is that a gloss that is commonly given on Descartes’ use of the term “certainty” as mere “psychological certainty” or even “inability to doubt” cannot be right. (The claim that *some* of Descartes’ uses of the term “certainty” are to be understood in this manner [Markie 1979, 99] is likewise contestable, since Descartes’ recurrent expression “impossible to doubt” may often, and perhaps always, be understood as “impossible to *call into* doubt,” that is, such that no [further] *reasons* for doubt can be provided.)

See also Circle, Cartesian; Clarity and Distinctness; Doubt; God; Truth

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KATHERINE MORRIS

CHANUT, HECTOR-PIERRE (1601–1662)

Born at Riom (Puy-de-Dôme), the son of a wealthy family of merchants, Pierre (as he is usually called) Chanut made a career in administration (tax and finance). Alongside his official duties he also worked with **Marin Mersenne** and Pierre Petit (1598–1677) on scientific questions, especially the barometric **experiments**. In the 1640s, he entered the foreign service and before long became one of France's top diplomats, more particularly in charge of the relations with Northern Europe. After traveling extensively in Sweden, Northern Germany, and the United Provinces, he returned definitively to France in 1655. Being a trusted client of Fouquet (1615–80), Chanut retired from the public service when the latter fell into disgrace (1661).

The first time Descartes mentions Chanut is in mid-March 1642 in connection with the objections of **Pierre Bourdin** (AT III 546). Meetings probably followed during Descartes' journey to France in 1644 because in 1645 Descartes already refers to Chanut as "one of my best friends" (AT IV 300). They also met at Amsterdam, when Chanut's ship made a stop on its way to Sweden

(Baillet 1691, II 279). It is through Chanut that **Claude Clerselier** entered the Cartesian orbit, Chanut being married (1626) to Clerselier's sister Marguerite. On arriving in Sweden, Chanut tried to interest **Queen Christina** in Descartes. His motives were primarily political, Descartes being an asset in his attempts to consolidate the relations with Sweden after the Thirty Years' War (1618–48) would be over. Chanut showed some of Descartes' letters to her (AT V 59), and by December 1646 another senior diplomat had already visited Descartes to sound him on a formal invitation (AT IV 535–36, CSMK 298–99). Although initially Descartes' reaction had been hesitant, he yielded after Chanut, on behalf of Queen Christina, asked his opinion on the sovereign good in the autumn of 1647 (AT V 81–86, CSMK 324–26). Descartes was formally invited in February 1649; he left the United Provinces in the autumn of 1649 and arrived in Sweden in September. At Stockholm, he and Chanut probably pursued their experiments with Torricellian tubes of various forms and formats. Descartes, who ascribed the effect to differences in temperature, must have wanted to profit from the cold climate. After Descartes' death in February 1650, Chanut took care of Descartes' papers and letters. In the winter of 1653–54, when he was on diplomatic mission at The Hague, he and **Christiaan Huygens** sorted the unpublished papers – the so-called Stockholm Inventory is probably the result of their efforts – before handing them over to his brother-in-law, Clerselier (AT X 5–12; see Descartes 2003, xvi–xxi).

See also Bourdin, Pierre; Christina, Queen of Sweden; Clerselier, Claude; Experiment; Huygens, Christiaan; Mersenne, Marin

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THEO VERBEEK

CHARLET, ÉTIENNE (1570–1652)

A **Jesuit**, Charlet was rector at La Flèche for most if not quite all of Descartes' eight years there and took special care of both his material and spiritual needs. There developed an attachment that lasted the rest of both their lives and was such that Descartes called him his "substitute father" (AT IV 156). (Descartes was in fact related to him on his mother's side.) He later became one of the five assistants to the head of the Society of Jesus, in Rome. Although Descartes had already at La Flèche exhibited his own way of disputing in **philosophy**, Charlet found no fault with him, and later Charlet was one of the Jesuits whom Descartes had in mind in his conciliatory comments about Scholastic philosophy as not being contradicted by his own but only completed by it in certain respects (AT IV, 225). Like **Mesland**, he was a missionary to America but, unlike him, Charlet returned to continue his career in France.

See also Jesuit

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THOMAS M. LENNON

CHARLETON, WALTER (1619–1707)

Born February 2, 1619, in Somerset, Charleton was a fellow of the Royal Society and served as physician to Charles I and Charles II. His philosophical reputation derives mainly from translation and popularization: his *A Ternary of Paradoxes* "Englishes" Jean-Baptiste Van Helmont, and his *Physiologia Epicuro-Gassendo-Charletoniana* translates parts of **Gassendi's** *Animadversiones*. Charleton is sometimes called an English Gassendist, although he disclaimed the label, counting himself among the "sect of electors" or eclectics (*Physiologia* 1.1.1.6). And despite his close association with **Hobbes** and **Margaret Cavendish**, he was heavily influenced by Descartes as well. His *Darkness of Atheism* uses Descartes' argument for the real distinction between **mind** and **body** (*Darkness* 1.2) and Descartes' **cosmological argument** for the **existence** of **God** (*Darkness* 1.1) in the Third Meditation as well as Epicurean material. The later

Immortality moves further from Gassendism to Cartesianism: for example, “*Des Cartes* hath irrefutably demonstrated, that the **Knowledge** we have of the **existence** of the Supreme Being, and of our own Souls, is not only Proleptical and Innate in the Mind of man, but also more certain, clear, and distinct, than the Knowledge of any Corporeal Nature whatever” (*Immortality* 119). He also wrote numerous medical works.

See also Cavendish, Margaret; Cosmological Argument; Dualism; Gassendi, Pierre; Hobbes, Thomas

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ANTONIA LOLORDO

CHARRON, PIERRE (1541–1603)

Charron was born in Paris and studied law and theology, the latter leading him to a teaching and pastoral career in the south of France. Engaged in the political-religious disputes in the time of the civil wars, he attacked the Protestant faith in *Les trois vérités contre les athées, idolâtres, juifs, mahumétans, hérétiques et schismatiques* (1593). The content of his lectures in Bordeaux and part of his sermons are gathered in his *Discours chrétiens de la divinité* (1604), where traditional theological themes are

introduced in a broad manual of natural philosophy. His main work however is *De la sagesse* (1601–4), an anthropological *Summa* focused on skepticism that was inspired by Montaigne and supported by neo-Stoic themes.

A copy of *De la sagesse* was offered to Descartes in 1619 in Neuburg an der Donau by the **Jesuit** Johannes B. Molitor. At the time, Descartes was living in the Bavarian settlement in order to find the peace necessary for the meditation cited in the *Discourse on Method*. The echoes of reading Charron are traceable especially in his account of morality. Even the first rule of the provisional moral code resumes almost literally the title of a chapter from *De la sagesse*, “To obey and observe the laws, customs, and ceremonies of the country.” Like Charron, Descartes credits the necessity of unquestionable authority of customs and laws, not because they are good or bad but because they ensure civil peace. In the first rule of *Rules for the Direction of the Mind*, Descartes claims that the object of sciences is not to be found among the diverse particular **truths** discovered by each discipline but in the “universal wisdom,” which is not of use for the Scholastic disputes but for guiding the will in all moments of life. Precisely this is the subject of *De la sagesse*, as stated in its preface: human wisdom, distinct from both the mundane and the divine. To attain it, science is indicated equally as an instrument and as an obstacle, if one focuses only on its particular results. “The true science of man” proposed by Charron foreshadows Descartes’ notion of universal wisdom, but it culminates in a moral theory, while the author of the *Meditations* searches for an ontological foundation of **knowledge**. Descartes rediscovers Charron in his later work, the *Passions of the Soul*, where he places generosity at the center of the **virtues**, a direct inheritor of the Charronian concept of *preud’homme* (wisdom), which designated the law of human nature leading the individual to fulfillment apart from divine grace. Like Cartesian generosity, Charronian wisdom is characterized by kindness, self-satisfaction, and resoluteness.

See also Mathesis Universalis, Virtue

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CHRISTINA, QUEEN OF SWEDEN (1626–1689)

Christina was the daughter of King of Sweden Gustavus II Adolphus Wasa and, from the day of her birth at Stockholm, was considered as the heir to the throne. In 1630 Protestant Sweden became involved in the Thirty Years' War. In November 1632, at the battle of Lützen, a Protestant victory, King Gustav was killed, and, at nearly six, Christina inherited the throne. In December 1644, at eighteen, Christina was officially coronated Queen of Sweden, but refused marriage with Charles Gustav Palatine, one of her cousins. She helped to bring an end to the Thirty Years' War by supporting a theological resolution that unified the Protestant religions.

The “Minerva of the North” began to question Descartes through letters written by **Pierre Chanut**, one of Descartes' friends and a minister of France to the Swedish government. In February 1647, Descartes answered Christina's questions: “What is love? Does the natural light by itself teach us to love **God**? Which is worse if immoderate and abused, love or hatred?” (AT IV 601, CSMK 306). Then Christina asked Descartes how to reconcile Christian religion with the hypothesis of an infinite world. He replied with the distinction between the “infinite,” reserved for God alone, and the “indefinite” world (AT V 51, CSMK 320) (see **infinite versus indefinite**). In September and November 1647, Christina asked Descartes' views about “the supreme good understood in the sense of the ancient philosophers.” With his answer to the queen, Descartes sent a letter to Chanut, including the copy of his letters to **Princess Elisabeth** on Seneca and the ancients, and a “little treatise on the Passions,” a forerunner of the *Passions of the Soul* (AT V 81–88, CSMK 324–27). Having begun to read the *Principles of Philosophy* in French, Christina invited Descartes to Sweden (February 27 and March 6, 1649), and Descartes left Holland on September 1, 1649. Descartes found himself soon disappointed by Christina's “great ardor” for “cultivating the Greek language” and “collecting many old books” rather than for philosophy (AT V 430, CSMK 383). He received “with respect” the order “to be in her library every morning at five o'clock,” a change in his habit of relaxing in bed late in the morning. She asked Descartes to write the libretto of a ballet to celebrate the “Birth of Peace” (the Peace of Westphalia) and to work “on the plan for an Academy.” Descartes presented them on February 1, 1650, of a harsh winter. He fell ill and died ten days later, almost two months shy of his fifty-fourth birthday.

In 1654 Christina abdicated at the age of twenty-seven, a decision breaking the line of succession. Among the reasons for her abdication were her strong aversion to marriage (“More courage is required for marriage than for war” is one of her aphorisms) and her interest in Catholicism. She named her cousin, Charles Gustav, as her successor and left Sweden. She renounced Lutheranism and converted to Catholicism on December 24, 1654. The pope accepted her conversion in Italy. When her cousin died in 1660 without an heir, she tried to recover her crown, but

her claim was refused. She returned to Rome where she died at fifty-three and was buried in St. Peter's Basilica.

Descartes' influence on her conversion to Catholicism has been discussed, and in a letter of 1667 quoted by Arckenholtz (1757–60), Christina mentioned the influence that Descartes and Chanut may have had on her conversion. But, as Cassirer (1942) notes, we have no details about Descartes' philosophical teachings to Christina.

See also Chanut, Hector-Pierre; Elisabeth, Princess of Bohemia; Infinite versus Indefinite; Passion; *Passions of the Soul*

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ANNIE BITBOL-HESPÉRIÈS

CIRCLE, CARTESIAN

In the Fourth Objections, **Arnauld** wrote:

I have one further worry, namely how the author avoids reasoning in a circle when he says that we are sure that what we clearly and distinctly perceive is true only because **God** exists. But we can be sure that God exists only because we clearly and distinctly perceive this. Hence, before we can be sure that God exists, we ought to be able to be sure that whatever we perceive clearly and evidently is true. (AT VII 214, CSM II 150)

The circular argument or strategy identified here has come to be known as the *Cartesian Circle*. The Circle is constructed from two arcs. The first is that **certainty** of the **truth** of clear and distinct **perceptions** depends on **God's attributes**. In the Fourth Meditation, for example, Descartes uses the Third Meditation understanding of God to prove the rule that everything perceived with **clarity and distinctness** is true. The second arc is that certainty of God's **existence** depends on a proof from clear and distinct premises.

Descartes was not impressed by Arnauld's observation. He responded by saying that an adequate explanation was found in his Second Replies and added:

To begin with, we are sure that God exists because we attend to the arguments which prove this; but subsequently it is enough for us to remember that we perceived something clearly in order for us to be certain that it is true. This would not be sufficient if we did not know that God exists and is not a deceiver. (AT VII 246, CSM II 171)

A vast literature has accumulated as the result of attempts to understand Descartes' response and evaluate how successful it is. It is an attractive problem for scholars because it is, on the surface, so simple to formulate, and Descartes' explicit treatments of the Circle are brief and cryptic. Moreover, the problem gains depth from its connection to central issues of **doubt**, **method**, clear and distinct perception, *scientia*, and the **knowledge** of God. As we shall see, the question of the Circle arises in texts that make some use of the method of doubt: *Discourse* IV, *Principle* I, and above all in the *Meditations*. It is in that work that Descartes makes the most extensive use of the method of doubt. It also features the most detailed explanation of how to prove methodically that God exists and how to derive methodically from God's attributes the rule that clear and distinct perceptions are true.

Before canvassing interpretations of the problem of the Circle, each of its arcs must be individually examined to bring out some important subtleties. Regarding clear and distinct perceptions, Descartes quite emphatically insists in the Second Replies that one cannot have a clear and distinct perception and simultaneously doubt it:

Now some of these perceptions are so transparently clear and at the same time so simple that we cannot ever think of them without believing them to be true.... For we cannot doubt them unless we think of them; but we cannot think of them without at the same time believing they are true, as was supposed. Hence we cannot doubt them without at the same time believing they are true; that is, we can never doubt them. (AT VII 144–46, CSM II 103–4. Cf. AT VII 58–59, CSM II 41; AT VII 65, CSM II 45; AT VII 69, CSM II 48;

AT VII 166, CSM II 117; AT VII 460, CSM II 309; AT IXA 205, CSM II 271;
AT III 64, CSMK 147; AT VIIIA 21, CSM I 207; AT IV 115–16, CSMK 233)

This might seem to suggest that Descartes did not think that the certain truth of clear and distinct perceptions is, after all, conditional on certainty of God's existence (as I discuss later in this entry). Remarkably, another set of texts clearly implies that Descartes thought that all clear and distinct perceptions *are* subject to *metaphysical doubt* before God is known. Rehearsing the reasons for doubt given in the First Meditation, Descartes wrote, "God could have given me a nature such that I was deceived even in matters which seemed most evident" (AT VII 36, CSM II 35). He offers the *cogito* itself as one of the examples of these "most evident" things. And in the Fifth Meditation the idea is repeated. "For I can convince myself that I have a natural disposition to go wrong from time to time in matters which I think I perceive as evidently as can be" (AT VII 70, CSM II 48. Cf. AT VII 77, CSM II 53; AT III 164–65, CSMK 147; AT VIIIA 6, CSM I 194; AT VIIIA 9–10, CSM I 197; AT VIIIA 16, CSM I 203). These texts characterize metaphysical doubt as perfectly universal before God is known in the right way. No matter how distinguished a perception is we cannot, at that time, discharge the hypothesis that our nature is such that it is false. So are clear and distinct perceptions dubitable or not? These apparently conflicting sets of texts can be reconciled. Clear and distinct perceptions cannot be doubted *while* they are being perceived. But when they are not being perceived they can *at that time* be doubted as a class under the general rubric of "supremely evident items." The psychological mechanism in play involves attention. A clear and distinct perception requires full attention, so there is no remaining cognitive space for attending to a reason for doubt while clearly and distinctly perceiving something. But in the First Meditation, there is a resolution to doubt whenever there is a reason to do so (AT VII 23, CSM II 15). Therefore, if a meditator shifts attention from a clear and distinct perception, paying attention instead to the metaphysical doubt, then one cannot be clearly and distinctly perceiving the first perception. So in this attenuated sense, even clear and distinct perceptions can be doubted. We can say that they cannot be *directly* doubted while one is having them, but they can be *indirectly* doubted afterward. The metaphysical doubt described in the second set of texts just cited is a metacognitive doubt that applies to one's nature as a clear and distinct perceiver. It is dispelled, but only temporarily, when a particular clear and distinct perception is attained. But while pursuing the method of doubt one is obliged to consider even the slightest reasonable doubt. One can be completely certain of the rule that clear and distinct perceptions are true, therefore, only if one is certain that an omnipotent, nondeceiving (or, more precisely, a perfectly benevolent) God exists. In other words, all knowledge depends on the knowledge of God (see, e.g., AT VIIIA 9, CSM I 197).

We now move to the second arc of the Circle, that is, that God's existence is certain because it follows from clearly and distinctly perceived premises. It seems there would be no Circle if one could somehow simply begin with a clear and distinct perception of God's existence. Descartes considers this in the Fifth Postulate of the geometrical exposition in Second Replies:

The **idea** of God contains not only possible but wholly necessary existence. This alone, without a formal argument, will make them realize that God exists.... For there are certain truths which some people find self-evident, while others come to understand them only by means of a formal argument. (AT VII 163–64, CSM II 115)

And this might seem to suggest that the certainty of God's necessary existence is, after all, not conditional on a clearly and distinctly perceived proof. Descartes goes on to explain the circumstances in which the condition obtains. Commenting on Proposition I of the geometrical exposition, Descartes writes that God's necessary existence

can be grasped as self-evident by those who are free of preconceived opinions, as I said above, in the Fifth Postulate. But since it is not easy to arrive at such clear mental vision, we shall now endeavor to establish the same result by other methods. (AT VII 167, CSM II 117–18)

The requisite freedom from preconceived opinions (or **prejudices**) can be achieved only by using "other methods," that is, methods other than direct intuition. Consequently, having committed oneself to this method's metaphysical doubt, it seems that breaking the Circle does require a proof of God's existence from prior clear and distinct perceptions. The right kind of proof is provided in the Third Meditation (see **cosmological argument**). We have seen that outside the method of doubt, Descartes maintains that each arc of the Circle is independently certain. But within that context the arcs are joined, giving rise to the puzzle of the Circle. It should be noted, however, that on the basis of these considerations, some scholars conclude that the method of doubt is designed primarily to uncover clear and distinct perceptions so that Descartes intended no close connection between doubt and certain knowledge. If that is right, then Descartes would have seen no interesting issue about a Circle after all (see Lennon 2008, ch. 6).

Given the strong reading of the metaphysical doubt as indirect, there is no straightforward way to make epistemic progress in the Third Meditation or analogous points in other texts. The doubt must somehow be qualified and then circumvented if the Circle is to be broken. There are three ways in which Descartes can be

interpreted as making this qualification (Newman and Nelson 1999). The first would be to regard some perception or set of perceptions as initially exempt from doubt so that they are exceptions to its universality. This attributes to Descartes what can be called an *Antecedent Exemption Strategy* for breaking the Circle. Methodical doubt is not absolutely universal in the sense described previously; there are some items to which it never applies. Descartes' project, therefore, is now to locate them and then use them to enlarge the set of exempt items. Variations of the strategy have been proposed that exempt the *cogito* alone, innate ideas alone, or everything that is clearly and distinctly perceived.

Aside from the suspicion that the Antecedent Exemption Strategy is Descartes' only possible way out of the Circle, it might be bolstered by one passage in the Third Meditation. Here Descartes might seem to make the unqualified claim that things revealed by the natural light are indubitable:

Whatever is revealed to me by the natural light – for example that from the fact that I am doubting [*ut quod ex eo quod dubitem*] it follows that I exist, and so on – cannot in any way [*nulla modo dubia esse possunt*] be open to doubt. (AT VII 38, CSM II 27)

Even here, however, Descartes' example of illumination by the natural light is most naturally translated from the Latin with the present progressive *doubting*. This text is, therefore, compatible with the reading according to which the *cogito* "and so on" are indirectly dubitable in the Third Meditation even though they "cannot in any way be open to doubt" while the natural light reveals them, that is, at the same time they are being clearly and distinctly perceived.

The Antecedent Exemption Strategy forcibly breaks the Circle; the Third Meditation proof of God's existence is deduced from premises it regards as indubitable. Its main weakness is that it cannot be reconciled with the many texts cited earlier that insist on the universality of indirect doubt. It also leaves unexplained the reconsideration of God's existence in the Fifth Meditation and Descartes' own claim to have resolved the Circle there instead of in the Third and Fourth Meditations (AT VII 71, CSM II 49; AT VII 146, CSM II 105). Moreover, versions of the Antecedent Exemption strategy that exempt all clear and distinct perceptions minimize the epistemic role of knowledge of God. It seems to consist only in providing a premise for the derivation of the truth rule in the Fourth Meditation. This overvalues the general rule that clearly and distinctly perceived things are true in comparison with individual truths. These considerations motivate alternative readings that characterize Descartes' strategy more favorably.

A second kind of interpretation that puts more emphasis on the texts expressing the universality of doubt can be called a *Subsequent Exemption Strategy*. Its most basic application understands Descartes' procedure as aiming to demonstrate that

the deliverances of clear and distinct perception are fully warranted, consistent, and reliable, as opposed to being absolutely true (Frankfurt 1970). As noted, clear and distinct perceptions are indubitable while one is having them, so one can bring off the Third Meditation Proof to clearly and distinctly perceive God's existence. And that, in turn, can be used in the Fourth Meditation to obtain the general rule that clear and distinct perceptions are true. These results might mean that all is well during the time that one is clearly and distinctly perceiving God's existence. But what happens if one remembers the First Meditation resolution to doubt whenever there is reason? If one again attends to the reason for metaphysical doubt, one is *no longer* clearly and distinctly perceiving God's existence, so it still holds that nothing is absolutely impervious to this doubt. This strategy accordingly exempts clear and distinct perceptions from doubt subsequent to God's existence being so perceived.

Absolute truth is never attained because of the universality of metaphysical doubt; nonetheless, subsequent to God's existence being demonstrated, clear and distinct perceptions are exempted from further application of methodic doubt. On this reading, Descartes is aiming at the lower goal of proving that reason is internally consistent or that clear and distinct perceptions are psychologically irresistible. Several variations of Subsequent Exemption exist (Loeb 1992). A more rigorous Subsequent Exemption comes from holding that proving God's existence from clearly and distinctly perceived premises does provide knowledge of the absolute truth of all clearly and distinctly perceived items – but only until metaphysical doubt is reconsidered. At that point, certainty can be reestablished by reproducing the proof. A regress of reproduced proofs is dismissed as unreasonable. The permanent reproducibility of the proof is considered as rendering all clearly and distinctly perceived items exempt from further doubt. Unlike Antecedent Exemption, Subsequent Exemption fits well with the stress Descartes places on remembering when responding to problems connected with circularity. When responding directly to Arnauld's question about circularity, that is the main point Descartes makes (quoted earlier; cf. AT VII 70, CSM II 48; AT VII 140, CSM II 100; AT VII 146, CSM II 144). The idea is that for something to count as knowledge of the highest standard, it is enough to remember having proved it from clear and distinct premises, provided that one is armed with the ability to reproduce the proof of God's existence.

A Subsequent Exemption Strategy that includes the reproducibility of a causal argument resulting in a clear and distinct perception of God's existence comes very close to being completely successful. It is a close fit with Descartes' texts, and it allows for the initial universality of metaphysical doubt. Following the method of doubt, the meditator's knowledge is transformed by the availability of a clear and distinct perception of God. The doubt that remains and necessitates the exemption is even slighter than what is induced in the First Meditation. It is

conclusively discharged whenever one is presently clear and distinct about God's existence and nondeceptiveness. But no meditator can, or should, sustain that state for long, and metaphysical doubt is then reproducible. But since the requisite clear and distinct perception of God is also reproducible by running through the causal proof, the regress of alternate states of doubt and certainty is not hard to dismiss. One might wonder, nevertheless, whether Descartes might have seen a noncircular way to establish absolutely perfect knowledge of clearly and distinctly perceived items.

A maximally ambitious Circle-breaking strategy of this kind builds on the reproducibility version of Subsequent Exemption (Newman and Nelson 1999). The idea behind it is that the procedure of the *Meditations* transforms the meditator from an initial state in which universal doubt prevails to a final state in which metaphysical doubt is fully discharged. In that final state, knowing God in the right way establishes clear and distinct perceptions as perfectly known *scientia* (see **knowledge**). For this reason it can be called a *Cognitive Transformation Strategy*. The transformation aimed at is more complete than what is provided by Subsequent Exemption. If the Cognitive Transformation Strategy can be brought off successfully, then neither Antecedent nor Subsequent Exemption is required to break the Circle. The Circle is instead straightened with one arc, or now line segment (clear and distinct perception), coming first in the dynamic, analytic process of meditating, while the other segment (God's existence) becomes epistemically prior (see **analysis versus synthesis**).

The structural problem with the Subsequent Exemption Strategy is that the meditator's access to the required idea of God is mediated by rehearsing the cosmological argument. The idea is thus unavailable just when it is needed – namely, when the metaphysical doubt is being attended to. This problem could be resolved only by access to the clear and distinct perception of God's existence and nondeceptiveness that was immediate, intuitive, and axiomatic. According to the Cognitive Transformation Strategy, this is exactly what is accomplished in the Fifth, and not the Third, Meditation. It contains Descartes' so-called **ontological argument** for God's existence, which is ignored by most commentators addressing the Circle (Gueroult 1953 is an important exception). The Fifth Meditation begins by alluding to the innateness of simple geometrical ideas and transitions to the recognition that

it is not necessary that I ever light upon any **thought** of God; but whenever I do choose to think of the first and supreme being, and bring forth the idea of God from the treasure house of my **mind** as it were, it is necessary that I attribute all perfections to him. (AT VII 67, CSM II 46–47)

A very strong case can be made that the ontological “argument” comes to no more than the direct intuition of God that Descartes claimed was possible in the passage

from Second Replies quoted earlier (Gueroult 1953, ch. 8; Nolan 2005). In short, the revelations of the Fourth Meditation, the connection with **geometry** in the beginning of the Fifth, and the discussion of the connection between **essence** and existence with regard to the “argument” itself, all bring the meditator to a state in which a clear and distinct perception of God’s existence, nondeception, and grounding of the truth rule (AT III 433, CSMK 196) is easily drawn from the mind.

This device blocks in a striking way the application of metaphysical doubt. That doubt, recall, results from the hypothesis that one’s nature has the defect that even clear and distinct perceptions are false. A sufficiently practiced meditator, however, cannot coherently formulate that hypothesis after practicing the method up to and including the Fifth Meditation. She recognizes that her nature derives not from an evil genius but from the supremely perfect God (AT VII 45, CSM II 31) whose perfections include creating her nature such that the truth rule holds. In other words, the very attempt to formulate the metaphysical doubt makes the meditator instead clearly and distinctly bring forth the innate idea of God. This cognitive process here is strongly analogous to the *cogito*. Just as the attempt to doubt one’s existence perforce leads to its affirmation, the attempt to metaphysically doubt one’s capacity for clearly and distinctly perceiving truth immediately leads to an intuition of the nondeceiving God. The metaphysical doubt is discharged because it cannot be coherently entertained. This is the crucial transformation that has taken place since the First Meditation where one’s confused perceptions of God and self left room to attend to what (in retrospect) are plainly confused reasons for metaphysical doubt.

A passage that is often thought to support the Subsequent Exemption Strategy is found in Second Replies:

What is it to us that someone may make out [*fingat*] that the perception whose truth we are so firmly convinced of may appear false to God or an **angel**, so that it is, absolutely speaking, false? Why should this alleged “absolute falsity” bother us, since we neither believe in it nor have even the smallest suspicion of it? (AT VII 145, CSM II 103)

Descartes might seem to be acknowledging that clear and distinct perceptions can indeed be false “absolutely speaking.” We cannot know, or even suspect, as much because clear and distinct perceptions are irresistible to us. But this need not “bother us” because we can demonstrate that our system of clear and distinct perceptions is internally coherent. But the Cognitive Transformation Strategy is a better fit for the text. Descartes says not that the skeptic makes a valid point but that we can ignore it because we do not care about absolute truth and falsity. Descartes says that the skeptic “makes out” or “feigns” the story that our clear and distinct perceptions can be false. His putting it this way is explained by his holding that the intuitive knowledge

of God renders the skeptics story incoherent. It is not just that we do not care about the skeptic's story, instead the made-up story makes no sense. The passage continues:

It is also no objection for someone to make out that such truths might appear false to God or to an angel. For the evident clarity of our perceptions does not allow us to listen to anyone who makes up this kind of story. (AT VII 146, CSM II 104)

The Cognitive Transformation Strategy is noncircular and is strongly supported by Descartes' writings, so it is possible that Descartes would have explicitly used it to exonerate himself from the charge of circularity had he taken the charge more seriously. It does not, of course, vindicate his project of establishing perfect knowledge. That project depends on being able to have Cartesian clear and distinct perceptions of the items he enumerates. More implausibly still, it requires that a careful meditator be able to intuit immediately the clear and distinct perception of God, by a process of eliminating confusions and prejudices (Nolan 2005). Objections to those tenets of Descartes could be overcome only by readers' confirming the tenets for themselves.

See also Certainty, Clarity and Distinctness, *Cogito Ergo Sum*, Cosmological Argument, Doubt, God, Knowledge, Method, Ontological Argument, Prejudice, Truth

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ALAN NELSON

CLARITY AND DISTINCTNESS

The expression "clarity and distinctness," including its adjectival and adverbial forms, is used in the literature, especially most recently, with the frequency and reverence befitting a mantra. *Cogito ergo sum* appears on t-shirts and in *New Yorker* cartoons, and well it might, since it is by Descartes' own account the fulcrum of his whole system. But, to change the metaphor somewhat, the system is generally taken to be driven by clarity and distinctness – the goal of the Cartesian **method**, which begins by applying **doubt** to the obscure and confused and ends with the certainty of the clear and distinct. In short, clarity and distinctness is what Descartes' **philosophy** is supposed to be all about.

The importance assigned to clarity and distinctness appears as follows. Seeking unshakable **certainty** about what cannot conceivably be false, Descartes arrives at the **knowledge** of his own **existence**, which cannot be challenged even by the supposition of an evil demon (see **doubt**). Secure in this knowledge, he asks what it is that makes this knowledge so certain and replies, near the outset of the Third Meditation, that in it "there is simply a clear and distinct **perception** of what I am asserting." Since what he is then perceiving could never turn out to be false, at least not while he is perceiving it, he has what is required for certainty of its **truth**. He then draws a momentous conclusion, which is the engine of his method thereafter. "So I now seem to be able to lay it down as a general rule that whatever I perceive very clearly and distinctly is true" (AT VII 35, CSM II 24). The task then is simply to find what is clear and distinct, which is Descartes' double-barreled criterion of truth.

Given the importance assigned to "clarity and distinctness," it is surprising that relatively little attention has been given to what Descartes means by clarity and distinctness. Also surprising, only once in his entire corpus does Descartes make an explicit effort to tell us. In the *Principle of Philosophy*, Descartes reiterates the truth rule from the Third Meditation (in the somewhat weaker form that we can avoid error by assenting only to what we clearly and distinctly perceive) and indicates how we often go wrong with respect to that rule. He then says:

I call a perception “clear” when it is present and accessible to the attentive [*attendenti*; i.e., attending] **mind** – just as we say that we see something clearly when it is present [and open; & *aperte*] to the eye’s gaze and stimulates it with a sufficient degree of strength and accessibility [*satis fortiter et aperte illum movent*]. I call a perception “distinct” if, as well as being clear, it is so sharply separated from all other perceptions that it contains within itself only what is clear. (AT VIII 22, CSM I 207–8)

Those commentators who attempt to exploit the interpretive possibilities of this text regard the notion of clarity as indicating the *immediacy* of perception, which, typically of all immediate perception in the period, is taken to be incorrigible, that is, incapable of being false. With no inference involved, the mind stands face to face before its object, in a way at least analogous to the perception of a color, or a pain, which just is what it seems to be. Descartes continues by saying that clarity of perception is necessary but not sufficient for distinctness, giving as an example the common perception of pain. While there is no mistaking a pain for a color, most of us confuse that perception with a **judgment** about something in a part of the **body** that they think resembles the painful sensation. In Descartes’ terminology later in the *Principles*, we confuse the pain as a **mode** of the mind with a part of the **body**, which is a mode of **extension**, and our perception becomes distinct only when we clearly see this difference and judge accordingly (see Kemp Smith 1963, 55–60).

The difference between clarity and distinctness is not that clarity is incorrigible, whereas distinctness is not. For distinctness too is never deceptive. In fact, just because a distinct perception is sharply separated from all others by exhaustively containing nothing but what is incorrigible (i.e., clear), there can be no reason for us not to take it to be true. So, a way to think about the difference between clarity and distinctness is that they each correspond to the two versions of the truth rule, the initial one preserving us from error and the concluding one giving us truth. This difference leads to another, namely, that distinctness is more difficult to achieve, just as truth is more than the mere avoidance of error. The method of doubt initially preserves us from error and only then, if applied properly, arrives at truth (see **error**, **theodicies** of).

Since they relate to truth values, which do not admit of degrees, clarity and distinctness must be regarded as absolute notions. Yet Descartes speaks of what is clearer and more distinct, as when we progress through the method of doubt to absolute and unshakable certainty. The relatively clear and distinct must indicate the more or less close approximations of the truth, as, for example, relative straightness indicates the more or less close approximation of absolute straightness.

What is it that is said to be clear (or obscure) and distinct (or confused)? There seem to be at least two possibilities: what is perceived, whatever that might be, or the perceiving of it. Usually, at least in the recent literature, it is taken to be the latter (see

Patterson 2008, esp. 231–33). In the period, the Cartesian **Nicolas Malebranche** tried to distance himself from what some have later called Descartes' psychologism (which would construe logical and epistemological notions as psychological). Malebranche focused therefore on what is perceived; but his preferred terminology, perhaps designed to mark this departure, was "evidence" and its various forms. The ambiguity is found in the term "perception" itself, which in French or Latin can, as in English, refer to either what is perceived or the perceiving of it. The same ambiguity is to be found in Descartes' term "**idea**," which, as he informs us, "can be taken materially, as an operation of the **intellect**, [or] alternatively, it can be taken *objectively*, as the thing represented by that operation" (AT VII 8, CSM II 7). So the frequent occurrence of the expressions "clear and distinct ideas" and "clear and distinct perceptions" does not by itself answer our question. Conceivably, indeed, clarity (or obscurity) might be a feature of the intellectual operation, but distinctness (or confusion) of its object. Descartes' example of the common perception of pain might be read in this way. We immediately perceive that we are in pain, but what we perceive, a mode of the mind, is confused with something in the body, a mode of extension.

The attempt, based on the text from the *Principles*, or any other Cartesian text, to regard "clarity" and "distinctness" as technical terms referring to a precise criterion of truth faces at least three inconveniences. First, nowhere in either the *Meditations* or the *Principles* does the word "criterion" appear, which would be astonishing if Descartes intended to propose a feature, of either a perceiving or its object, that reliably indicated truth. For "criterion" is the word for such a feature in the literature dating to antiquity with which Descartes was familiar. The word he uses in the Third Meditation, when introducing the truth rule, is *regula*, which in classical Latin means a straight piece of wood, or a *ruler*, a meaning that suggests the standard view that Descartes was dealing in criteria. But it can also mean, figuratively, a rule, pattern, example, or *model*, which gives Descartes' procedure a rather different cast.

Second, whatever Descartes was about in proposing his truth rule, it is unlikely that he meant "clarity" and "distinctness" as technical terms in expressing it. For in the very next paragraphs, in referring to what satisfies the truth rule, or appears to do so, Descartes refers not to the clear and distinct, but to the certain and the evident, to the evident, or simply to the clear, which, as we have seen, would be insufficient for truth. According to Laporte (1988, 142 n. 1), "to perceive (*voir*, or to know through intuition), to be aware, to know evidently, to know clearly and distinctly, must be taken as synonymous." This slippage in terminology is not only an indication that *clarity* and *distinctness* are not terms of art for Descartes but also, according to the seventeenth-century critic **Pierre-Daniel Huet** (2003, ch. 2), in one of the most devastating attacks ever on Descartes, an indication that his system is fraught with substantive difficulties in dealing with skepticism.

Only in the *Principles* does Descartes deploy the terms with anything like the precision of the **definitions** he gives them there. Perhaps he was imposing an

artificial precision on them in what was, after all, intended as a textbook account of his system. At a minimum, however, the definitions are not inconsistent with Cartesian principles, and even as defined, the terms are not without use. On the contrary, he immediately puts the definitions to good use in his brief account of pain, which is not just a good example of the distinction but an account on which his whole system crucially depends. Moreover, he then exploits the usage in drawing the distinction between thinking **substance** and corporeal substance.

It might be that in the *Principles* Descartes was tightening his use of the terms and that therefore an appeal to apparently loose usage earlier in the *Meditations* is not necessarily relevant. Previously in the *Principles*, Descartes makes a general point about the senses similar to the later one about pain: so long as what is clear and distinct, whether we are awake or asleep, is kept separate from the obscure and confused, we are in a position to recognize what is true. Crucially, he adds that “there is no need for me to expand on this point here, since I have already dealt with it in the *Meditations*” (AT VIII 17, CSM I 205). So, what he explicitly says about clarity and distinctness in the *Principles* might be a more precise account of what is at least implicit in the *Meditations*.

A still more precise account of the terms has recently been developed. The account in question appeals to a notion in the *Rules for the Direction of the Mind* called **enumeration**, which is taken to be similar to the set-theoretical notion of a partition. A distinct idea would be one whose elements belong to exactly one enumeration of the modes of either of the principal **attributes**, **thought** or **extension**. And an idea can be clear in one of two strong senses, depending on whether the idea is an unanalyzable simple or a properly structured complex or, in a weak sense, if it exhibits the elements of its object (Kurt Smith 2001 and 2010, pt.2).

At this point, however, there emerges the third inconvenience encountered by any account, however precise and heuristically useful, that construes clarity and distinctness as criteria: namely, that it leads immediately to the alleged **Cartesian Circle** of the *Meditations*. First explicitly floated by **Arnauld** in the Fourth Objections, the circularity is supposed to occur when Descartes attempts to go beyond the *cogito*. He attempts to prove the reliability of clarity and distinctness as criteria of truth by proving the **existence** of a veracious **God** who would not deceive him in such an instance; but he proves the existence of God by appeal to the very clarity and distinctness that God’s existence is supposed to guarantee. While the claim *I am, I exist* might be indubitable, there is a cleavage between that claim and any criteria such as clarity and distinctness on which it is accepted, and, as the skeptical tradition from antiquity had argued, there is no way to bridge the cleavage short of an infinite regress, circular argument, or just begging the question. This is the criterion-of-criteria problem: by what criterion do I know that clarity and distinctness are reliable criteria of truth?

Now, it is possible, but not likely, that the central argument in the central text of early modern philosophy is fallacious in just this way. Perhaps, then, there is an interpretation that avoids the circle, and also accounts for the relevant texts, while also satisfying such constraints as the absolute or relative analogy between clarity and distinctness and straightness. One such interpretation comes from a fourth possibility of what is taken to be clear and distinct. It is neither a perceiving, nor its object, nor a combination of the two, nor anything taken in the Carnapian material mode of speech. Instead, the expression should be taken formally, as an operator over the claim being made. So, “I clearly and distinctly perceive that God exists,” for example, should be read as “Certainly, God exists.” Clarity and distinctness are not criteria in need of justification by some other criterion, because they are not criteria at all (Lennon 2008, ch.5).

A deflationary account of clarity and distinctness, which avoids the pitfalls of the criterial characterization, would be to regard the expression as simply indicating what is taken to be certain knowledge. That is, the expression indicates that what follows satisfies Descartes’ truth rule, for which the *cogito* is the model. In defeating the evil demon, Descartes thereby sees what he needs to be certain about anything, which is to see its truth as he sees the truth that he exists. “This would not be enough to make me certain of the matter if it could ever turn out that what I perceived with such clarity and distinctness was false” (AT VII 35, CSM II 24). Later, in the *Principles*, Descartes tells us that what cannot turn out to be false is what is seen to be immediately perceived, distinct from all else, which is not the criterion for certain knowledge, but that knowledge itself.

See also Certainty; Circle, Cartesian; *Cogito Ergo Sum*; Doubt; Enumeration; God; Huet, Pierre-Daniel; Intellect; Knowledge; Method; Perception; Truth

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THOMAS M. LENNON

CLAUBERG, JOHANNES (1622–1665)

Clauberg was born at Solingen (Germany) in 1622. Under the influence of Gérard de Neufville (1590–1648), his **philosophy** teacher at Bremen, he became interested in the works of Jan Amos Comenius (1592–1670). In 1644 that led him to continue his studies at Groningen with Tobias Andreae (1604–76), professor of history and Greek, and to become deeply involved with the Comenian movement. After two years at Groningen and an extended journey to France and England, Clauberg returned to the United Provinces in 1648. Meanwhile his first book was published at Groningen – a text displaying strong Comenian influences (Clauberg 1647). Clauberg went to Leiden to attend the lessons of Johannes de Raey (1622–1702), already a prominent Cartesian. In November 1648, Clauberg was sounded on a professorship in theology at Herborn (Germany), but he reacted saying that he preferred a professorship in philosophy. Eventually he had to teach both philosophy and theology. At Herborn, Clauberg and his friend Christoph Wittich (1625–87), assistant professor of **mathematics** and, like himself, an outspoken Cartesian, became the object of attacks on behalf of the orthodox, which in 1651 led to the official adoption of Aristotelian rule. As a result, Clauberg and Wittich accepted a call to Duisburg (Germany), where Clauberg would remain until the end of his years. Apart from defending Descartes against orthodox attacks (Clauberg 1652, 1655), Clauberg's main efforts were directed at normalizing Cartesian philosophy, that is, at reintegrating an essentially nonacademic philosophy into the professional academic tradition. This meant not only that he reduced Cartesian texts to a didactic format but also that he supplied what had been left uncompleted by Descartes himself. Apart from explaining and defending Descartes' **metaphysics** and **physics**, he notably produced an *Old and New Logic* (1654). In this book, Clauberg attempts to rewrite logic in Cartesian terms, presenting it as a "**medicine** of the **mind**" and integrating into one corpus all disciplines that are somehow concerned with **method**, including

traditional logic, the logic of invention, and the method of interpretation. Until the *Logic of Port-Royal* (1662), this book would remain the standard textbook of modern logic. Eventually Clauberg's name became almost synonymous with Descartes', especially in Northern Europe. Apart from his properly philosophical work he also organized theological discussions and did etymological research on the German language (Clauberg 1663). Thirty years after his death, the Amsterdam philosopher Johann Theodor Schallbruch (1655–1723) published a collective edition of his works, including some unpublished manuscripts in the possession of Clauberg's son.

See also Cartesianism, Method

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THEO VERBEEK

CLAVIUS, CHRISTOPHER (1538–1612)

Clavius was the preeminent mathematician and astronomer in the **Jesuit** order in the sixteenth century. Very little is known about his early life, apart from the fact that

he was born in the German region of Franconia, near the town of Bamberg. Even his name is a matter of conjecture: the Latinized “Clavius” has been suggested to derive from the German “Schlüssel” (key) or “Klau” (claw), but no convincing evidence as to his name is known to survive. Clavius entered the Jesuit order at Rome in 1555, admitted by its founder, Saint Ignatius of Loyola. He matriculated at the University of Coimbra in Portugal in 1556, where his mathematical talents were obvious, but the weakness of the Coimbran curriculum and instruction required him to be essentially self-taught in the subject. In May 1561 Clavius returned to Rome, where he began his study of theology at the Collegio Romano. Ordained in 1564, he began teaching **mathematics** (including astronomy) at the Collegio Romano in the same year; aside from a sojourn of several months to Messina in 1574 and a two-year stay in Naples in 1595–97, Clavius remained in Rome as professor of mathematics at the Collegio for the rest of his life.

Clavius’s first published work was his influential *Commentarius in Sphaeram Joannis de Sacro Bosco*; it appeared in 1570 and was the standard textbook on astronomy for generations. Indeed, Tycho Brahe, **Johannes Kepler**, and **Galileo Galilei** were all influenced by it. Clavius’s astronomical work made him highly instrumental in the calendar reform of 1582 that resulted in the introduction of the Gregorian calendar.

Clavius’s primary contributions to pure mathematics came in the context of his Latin edition and extensive commentary on the *Elements* of Euclid, which first appeared in 1574 and was the main text used in the Jesuit mathematical curriculum. Descartes’ education at La Flèche exposed him to the works of Clavius, certainly through his edition of Euclid and quite probably to his 1608 *Algebra* (another standard textbook in the Jesuit curriculum). Descartes was not in the habit of citing any prior sources for his mathematical work, so the Cartesian oeuvre contains almost no references to Clavius. In a 1629 letter to **Mersenne**, Descartes mentioned Clavius’s pointwise construction of the curve known as the quadratrix in his edition of the *Elements*, which Descartes took as an instance of a line that is not truly geometrical because it “can only be completely traced by knowing two **motions** that have no dependence upon one another” (AT I 71). In a letter to Charles Cavendish from August 1644, the English mathematician John Pell reports that Descartes “says he had no other instructor for Algebra than the reading of Clavy algebra above 30 yeares agoe” (AT IV 730–31). What Descartes took away from his encounters with the mathematics of Clavius was a sound knowledge of **geometry** and algebra. His insight was to combine these two sciences in a way that Clavius himself had not imagined. The result was Descartes’ *Geometry* of 1637, which represents a decisive break with the mathematics of Clavius and his tradition.

See also Geometry, *Geometry*, Jesuit, Mathematics

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DOUGLAS JESSEPH

CLERSELIER, CLAUDE (1614–1684)

Clerselier was a lawyer at the Parlement of Paris, paymaster general in Auvergne, and resident for the King of France in Sweden. He was the brother-in-law of **Pierre Chanut**, who married Clerselier's sister Marie-Marguerite and became a go-between for Descartes and **Queen Christina of Sweden**. He was also the brother-in-law of **Jacques Rohault**, one of Descartes' followers, whom he hoped would marry one of his two daughters as a way of establishing links with his philosophical family.

Descartes and Clerselier met in Paris in 1644 and subsequently developed a close working relationship and friendship. With the **Duc de Luynes**, Clerselier translated the French edition of *Meditations on First Philosophy* (as *Les méditations métaphysiques*) (1647, republished in 1661). We also owe to him the revised **Picot** translation of the *Principles of Philosophy* for the fourth Paris edition of 1681, and the publication of Descartes' **correspondence** in three volumes (1657, 1659, and 1667), arranged not in chronological order but by following an order of reasons that supported the reception of **Cartesianism** in the same period.

Generally speaking, Clerselier's choices, including his translation choices, show his strong desire to protect Descartes' reputation after his death. Let us consider two examples of this. First, his posthumous publication of the *Treatise on Man* – accompanied by the *Treatise on the Formation of the Fœtus* (today known by the title *Description of the Human Body*), Louis de la Forge's *Remarques*, and the French translation of the preface to Florent Schuyt's Latin edition (1662) – offers a preface that highlights the real **distinction** of **mind** and **body** and **Augustine's** authority. Clerselier imports into the text of *Treatise on Man* (which Descartes wrote first) the metaphysical developments of the *Meditations*, which Clerselier considers to be first in the order of reasons and the only guarantee against an empirico-materialist interpretation of *Treatise on Man*. Second, Clerselier claims in the preface to the third volume of his edition of Descartes' correspondence to have forged a letter to **Gilles Personne de Roberval** in which Descartes defends himself against the latter's attacks. This letter was read publicly on July 6, 1658, during a session of Louis Habert de Montmor's *Académie*; it comprised long excerpts from *The World*, which Clerselier did not edit until 1677, reestablishing the initial continuity between this work and chapter 8 of the *Treatise on Man*.

To fully understand Clerselier's contribution to the reception and dissemination of Descartes' ideas, one must also consider his social networks. Two examples may also be cited here. First, Urbain Chevreau (1613–1701), secretary to **Queen Christina of Sweden** from 1652 to 1662, reveals that he is in possession of Descartes' *Treatise on Man*, thanks to "Monsieur de la Voyette, a gentlemen of the Queen, who was a page boy to the Prince of Orange and who received it from **Princess Elisabeth**, a famous pupil of Monsieur Des Cartes" (1697, 102–3). He lends the book to Chanut, a copy of which finds its way into Clerselier's hands, forming the basis for the 1664 edition. Thanks to Clerselier's connections, we can compare this rare original manuscript of the *Treatise* with the reordered edition of the text with which we are familiar. Second, in his edition of the letters, Clerselier was reluctant to include the exchanges with **Mesland** on **transubstantiation**. However, his ambition was to make it his "last work ... in order to bring all the works of Monsieur Descartes to a close" (to Berthet; August 27, 1659). He thus circulated Descartes' letters to Mesland among several theologians such as Jean Berthet (a Jesuit), Father Viogué (Descartes' confessor in Sweden), Dom Antoine Vinot and **Robert Desgabets** (Benedictines), and the **Oratorian Nicolas-Joseph Poisson**. This underground campaign to win support for the Cartesian **explanation** of the Eucharist was carried out so vehemently that, according to some interpretations, it was connected with the placing of Descartes' works on the church's Index of Prohibited Books in 1663, and severe reprimands were directed at Clerselier, Rohault, and Desgabets by the archbishop of Paris in 1671. This fascinating case can be reconstructed from manuscript 366 at the Municipal Library of Chartres.

During his stay in Paris in 1676, Clerselier allowed **Leibniz** to read Descartes' papers. He bequeathed them to Jean-Baptiste Legrand when he died. The annotations made by Legrand and **Adrien Baillet** on Clerselier's copies of the correspondence have provided both new lines of research and new subjects for debate.

See also Baillet, Adrien; Cartesianism; Chanut, Hector-Pierre; Correspondence; Luynes, Duc de; Mesland, Denis; Rohault, Jacques; Transubstantiation

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DELPHINE ANTOINE-MAHUT

COGITO ERGO SUM

"I think, therefore I am" is the popularized formulation of Descartes' famous *cogito ergo sum* (hereafter, "*cogito*"). The *cogito*'s epistemological significance is supposed to

derive from its status as an utterly self-evident **truth** – “the first and most certain of all to occur to anyone who philosophizes in an orderly way” (AT VIII A 7, CSM I 195). “Orderly” philosophizing involves a program of methodic **doubt** – doubt resistance, or *indubitability*, being the central criterion of **knowledge**. Some texts express the *cogito*’s underlying point in terms of doubt (itself a form of thinking): “It is not possible for us to doubt that we exist while we are doubting; and this is the first thing we come to know” (AT VIII A 6f, CSM I 194). Barry Stroud (2010, 518) remarks that the *cogito* “is certainly among the most important and longest-lasting ingredients of Descartes’s legacy.” Though Descartes’ treatment of the *cogito* is history’s most famous, it is arguably not the first. Augustine of Hippo presented a remarkably similar version of his own: “If I am mistaken, I exist” (*Si fallor, sum*). The differences in formulation are not insignificant. Lively debates persist concerning Descartes’ own formulation.

The most serious debate about formulation concerns *inference*. Versions of the *cogito* appear in each of Descartes’ three main published philosophical works. The “canonical” formulation (as I shall call it) includes an explicit inference – “I am thinking, therefore [*ergo*] I exist.” This version appears in two of the works: the *Discourse* (1637) (*je pense, donc je suis*), and the *Principles* (1644) (*ego cogito, ergo sum*). However, Descartes’ masterpiece, the *Meditations* (1641), presents a rather different formulation. The formula there occurs early in the Second Meditation in the context of an effort to find an indubitable truth: “So after considering everything very thoroughly, I must finally conclude that this proposition, *I am, I exist* [*Ego sum, ego existo*], is necessarily true whenever it is put forward by me or conceived in my **mind**” (AT VII 25, CSM II 17). Which of these represents Descartes’ official formulation? What follows are three main interpretive options.

One option is a *noninferential* interpretation. The most influential account comes from Jaakko Hintikka, who argues that the *cogito* should be understood as a performative utterance. Focusing on the Second Meditation passage, Hintikka (1962, 16) finds no logical inference:

In Descartes’s argument the relation of *cogito* to *sum* is not that of a premise to a conclusion. Their relation is rather comparable with that of a *process* to its *product*. The indubitability of my own **existence** results from my thinking of it almost as the sound of music results from playing it.

Because *I exist* (*sum*) does not follow logically from *I think*, argues Hintikka, Descartes cannot intend this as a logical inference – that is, unless he blundered. Hintikka (1962, 8) rhetorically asks: “Hamlet did think a great many things; does it follow that he existed?” In what sense, then, does *I exist* “result from” *I think*, if not the logical sense? Hintikka’s answer invokes nonlogical notions of inconsistency and verification. The statement “I do not exist” is not, per se, logically inconsistent; however, Hintikka suggests that the act of *thinking* the statement – the thought act, the cognitive

performance – is (what he calls) *existentially* inconsistent: that is, one cannot think the statement *and* believe it. Likewise, he suggests that the thought act of “I exist” is existentially self-verifying, in that one cannot think it without believing it. The very point of the Latin term *cogito*, adds Hintikka (1962, 17), is “to express the performatory character of Descartes’ insight; it refers to the ‘performance’ (to the act of thinking) through which the sentence ‘I exist’ may be said to verify itself.” In a similar vein, Zeno Vendler highlights the unique conditions of inconceivability arising from first-person contemplation. Note, for example, that I can conceive the nonexistence of a person with my name, or a person with my social security number and birthdate. But I cannot conceive of *my* nonexistence. Vendler (1984, 117) notes that “in this sense ‘I exist’ is necessarily true whenever and whatever I think.”

Further considerations lend support to a noninferential interpretation. One factor is the broader context in which the *cogito* arises. It functions more or less as an initial step in a grand argument; it is the first of many indubitable truths from which substantive conclusions are eventually drawn. Descartes likens his method to that of the geometers. We are to begin with simple, self-evident truths and then derive the less-evident truths via inference. This understanding of Descartes’ **method** seems to require first truths that are noninferential. Accordingly, the *cogito* should be an intuition, not a **deduction**. One might indeed read the following Second Replies passage as conveying some such point:

When someone says “I am thinking, therefore I am, or I exist” [*ego cogito, ergo sum, sive existo*], he does not deduce existence from **thought** by means of a **syllogism**, but *recognizes it as something self-evident by a simple intuition* of the mind. This is clear from the fact that if he were deducing it by means of a syllogism, he would have to have had previous knowledge of the major premiss “Everything which thinks is, or exists”; yet in fact he learns it from experiencing in his own case that it is impossible that he should think without existing. (AT VII 140, CSM II 100; emphasis added)

On the other hand, as Margaret Wilson (1978, 56) observes, “the claim that the *cogito* is an inference ... is not equivalent to the claim that it is a syllogism.” What this passage denies is only that the *cogito* is a syllogism; indeed, the text quite explicitly addresses the canonical formulation of the *cogito* – including the explicit *ergo*.

A second interpretive option is an *inferential* interpretation. The most obvious support for this reading is the explicit *therefore* (Latin *ergo*, French *donc*) occurring in the canonical versions. Less obvious, on this interpretation, is how to explain the differences in the Second Meditation formulation. On one explanation, the differences are more stylistic than substantive. For example, the Second Meditation version is surely more discursive than formulaic: “I must finally conclude that this proposition, *I am, I exist*, is necessarily true whenever it is put forward by me or conceived in my

mind.” Yet even this discursive version *is*, after all, inferential: “I must finally conclude” (*enfin il faut conclure*) is an explicit expression of inference to the conclusion, *I exist*. Another difference in the Second Meditation account may seem important. The premise of the canonical formulation cites my *thinking*, generally, whereas the Second Meditation cites my *conceiving* specifically the proposition, *I exist*. But this difference, too, is perhaps only cosmetic. Descartes maintains that the *I think* is perfectly general – applying to any form of thinking. In the context of the *Meditations*, it arises in a program of methodic doubt – the phrase “whenever it is put forward by me or conceived in my mind” is an allusion to the earlier effort at doubting the proposition, *I exist*. Any effort at *doubting* is, in Descartes’ scheme, a form of *thinking*; and any such effort at doubting *I exist* involves *conceiving* that very proposition. Arguably, then, the canonical formulations and the *Meditations* can be seen as presenting a relevantly similar inferential account. Note that not all inferential interpretations agree on the details of formulation. For example, Janet Broughton’s interpretation (2002, 117ff.) renders the inference in terms of *two* premises.

A third interpretive option incorporates insights from the other two, allowing the *cogito* to be both an intuition and an inference. I shall call this the “Intuitively Grasped Inference” interpretation. *Prima facie*, this option may seem incoherent – entailing that a single proposition is both inferential and noninferential. To help see that this is not what the interpretation entails, consider a distinction. It is one thing for a propositional *content* to include an inference: this is a *logical* fact about the *proposition* – about its internal structure. It is quite another thing for the mind’s *apprehension* of that content to be grounded in inference: this is an *epistemic* fact about the *mind* – about how it comes to know the proposition. One might object that the latter fact *is* actually about the proposition – namely, the fact that the proposition can be apprehended only via inference. But as long as it is possible that a proposition with inferential content is apprehended without inference, then the third interpretive option is not incoherent. Other examples illustrate this possibility. Consider that *modus ponens* may be formulated as a single proposition with inferential content: “ $(x \rightarrow y) \ \& \ x$, therefore y .” Yet the standard view is that *modus ponens* may be apprehended self-evidently, thereby illustrating the possibility of an intuitively grasped inference. We may view the *cogito* in an analogous manner. Descartes seems to allow that the same content may be regarded in various ways, as Edwin Curley (1978, 79) explains: Descartes “consistently blurs the distinction between inferences and propositions by referring to the whole formula ‘I think, therefore I am’ as a truth, a first principle, a proposition, and a conclusion.” Indeed, Curley (1978, 80) suggests that we can regard the *cogito*’s inference in terms of its “conditionalization,” namely, “If I think, then I exist.” In a similar vein, Anthony Kenny (1968, 55) suggests that, for Descartes, “what is from one point of view intuited is from another point of view deduced,” citing *Rules* 3 for support. Understood in this way, we can regard the *cogito* as an

inference that itself may be intuited, as Kenny (1968, 55) explains: “The intuition in the *cogito*, if I am right, is not the intuition of existence, but the intuition that the conclusion follows from the premises.” Not only does the Intuitively Grasped Inference interpretation explain how the *cogito* is both an inference and an intuition; it also preserves its role as a *first principle* in Descartes’ epistemology – a self-evident truth at the foundations of knowledge.

Moving beyond the debate about these interpretive options, questions arise concerning Descartes’ appeal to necessity. What does he think is necessary, and in what sense? What he thinks is “necessarily true” (*necessario esse verum*) is not that *I exist*, as if I were a necessary being, but rather that I exist *whenever* I am thinking – that is, “whenever” (*quoties*) the proposition that *I exist* “is put forward by me or conceived in my mind.” But in what sense necessary? As noted, on some interpretations Descartes does not intend the necessity to be understood as strictly logical (cf. Hintikka 1962 and Vendler 1984). We might add that Descartes’ emphasis on *indubitability* suggests a primary interest in the *cogito*’s epistemic status – namely, an interest in truths to which we cannot but assent, when attending to them clearly and distinctly. In any case, the *cogito* is not easily expressed in first-order logic, nor does first-order logic neatly map onto seventeenth-century conceptions of logic. Whatever its logical status, the sense that the *cogito* involves a real necessity is captured well in Stroud’s (2010, 518) observations: “A thinker obviously could never be wrong in thinking ‘I think’”; moreover, “no one who thinks could think falsely that he exists.”

Three further aspects of the *cogito*’s formulation are worth noting. First, it should be formulated in the *present tense*. It is no good for me to claim, “I was thinking, therefore I exist,” or “I am thinking, therefore I will continue to exist.” Neither inference is any good. As Descartes writes: “For it could be that were I totally to cease from thinking, I should totally cease to exist” (AT VII 27, CSM II 18).

The second aspect of the *cogito*’s formulation worth noting is that it must be rendered in terms of the mental activity of *thinking*, rather than in terms of bodily activity. For example, it is no good for me to claim, “I am walking, therefore I exist.” For it will be possible for me to doubt the premise, as Descartes explains in *Principles* I.9:

For if I say “I am seeing, or I am walking, therefore I exist,” and take this as applying to vision or walking as bodily activities, then the conclusion is not absolutely certain. This is because, as often happens during sleep, it is possible for me to think I am seeing or walking, though my eyes are closed and I am not moving about; such thoughts might even be possible if I had no body at all. (AT VIIIA 7, CSM I 195)

Descartes adds that if we instead “take ‘seeing’ or ‘walking’ to apply to the actual sense or awareness of seeing or walking” – as in “I am aware of walking,” or “I seem

to be walking” – then full **certainty** is restored. This suggests that not all uses of the English terms “thinking” and “thought” are sufficiently broad to capture what the term *cogito* is intended to convey. As Bernard Williams (1978, 78) observes, “in English, such terms are specially connected with ratiocinative or cognitive processes. For Descartes, however, a *cogitatio* or *pensée* is any sort of conscious state or activity whatsoever.” Descartes makes this point, in the same passage:

By the term “thought,” I understand everything which we are aware of as happening within us, in so far as we have awareness of it. Hence, *thinking* is to be identified here not merely with understanding, willing and imagining, but also with sensory awareness. (AT VIIIA 7, CSM I 195)

It is in this broad sense of the term “thinking” – roughly, conscious awareness – that we are to understand the *cogito*.

The third noteworthy aspect about formulation is that the *cogito* should be formulated in the *first person*. I can doubt such premises as that “Hamlet thinks,” or that “Descartes thinks,” but I cannot likewise doubt *my* thinking.

The issue of the *cogito*’s first-person formulation raises a well-known line of objection: Descartes goes too far in formulating the *cogito* in terms of an “I.” The statements “There is thinking” and “I am thinking” mean something different, yet, on this objection, conscious introspection entitles Descartes only to the former claim, not to the latter. Expressing the objection, Bertrand Russell (1945, 567) writes that “the word ‘I’ is really illegitimate”; he thinks Descartes should state “his ultimate premiss in the form ‘there are thoughts.’” Granted, “the word ‘I’ is grammatically convenient,” thinks Russell, but it “does not describe a datum.” The objection is potentially devastating to the *cogito*. For if the occurrence of the “I” is illegitimate in the premise, then it is likewise illegitimate in the conclusion.

Does introspection reveal an “I” – a *self* – or, instead, none other than occurrent thoughts and **perceptions**? Famously, David Hume wrote:

For my part, when I enter most intimately into what I call *myself*, I always stumble on some particular perception or other, of heat or cold, light or shade, love or hatred, pain or pleasure. I never can catch *myself* at any time without a perception, and never can observe any thing but the perception. (*Treatise on Human Nature*, 1.4.6)

Perhaps surprising is that Descartes is sympathetic to the concern. He refers to the “puzzling ‘I’ which cannot be pictured in the **imagination**” (AT VII 29, CSM II 20), adding that “we cannot initially become aware of a **substance** merely through its being an existing thing, since this alone does not of itself have any effect on us” (AT VIIIA 25, CSM I 210). But he would add that proper Cartesian methodology

avails us of innate resources that Hume did not acknowledge, including the metaphysical principle that “nothingness possesses no **attributes**”: from an awareness of thinking, “we can infer that there must also be present an existing thing or substance to which it may be attributed.” Even granting this, however, Descartes needs some other explanation of the “I.” For, in context, the *cogito* is supposed to be the first item of knowledge, epistemically prior to any further metaphysical principles.

Another kind of solution is suggested in the following passage:

Is it not one and the same “I” who is now doubting almost everything, who nonetheless understands some things, who affirms that this one thing is true, denies everything else, desires to know more, is unwilling to be deceived, imagines many things even involuntarily, and is aware of many things which apparently come from the senses? ... The fact that it is I who am doubting and understanding and willing is so evident that I see no way of making it any clearer. (AT VII 28–29, CSM II 19)

Prima facie, it can seem that Descartes is not grasping the problem – that he is simply asserting what is at issue. But there is a better reading. Arguably, the subjective character of consciousness includes a particular point of view; a perspective seeming to endure, over time, through other changes in thinking – as if it is “the same ‘I’” that understands, affirms, denies, desires, wills, imagines, and so on. Elsewhere, Descartes refers (metaphorically) to the “mind’s eye” (*mentis oculis*), a reference occurring in a nonsensory context (AT VII 36, CSM II 25). The suggestion in these passages is that there is *something it’s like* to be thinking; indeed, something it’s like *for* something – for a *thinker* of some sort. The subjective character of thinking includes a feeling of *mineness* – an element expressed well by the term “I.” This aspect of thought is difficult to characterize, but, as Descartes writes, it is “so evident that I see no way of making it any clearer.” The Humean critic will reply that the experience of “mineness” is, at best, *bad* by – but not itself *of* – the supposed thinking self. This reply is correct as far as it goes. Yet the relevant issue is not whether introspection reveals the self *itself*, but whether it reveals any plausible candidates for the “I” to signify. Importantly, there need not actually *be* a substantial self in order for introspection to suggest one. On the proposed reading, the *cogito* is not (yet) known to entail a substantial self – that is, not in its epistemically original formulation. The “I” is intended as an ontologically neutral placeholder for *whatever* might eventually be demonstrated as having thoughts. As Descartes writes, in the sentence immediately following the *cogito* passage in the Second Meditation: “But I do not yet have a sufficient understanding of what this ‘I’ is, that now necessarily exists” (AT VII 25, CSM II 17).

Descartes purports eventually to establish that the *whole essence* of minds is thinking. At that juncture, the *cogito* inference could be run, equally well, in the other direction: *I exist, therefore I am thinking*.

See also Analysis versus Synthesis, Certainty, Deduction, Doubt, Essence, Existence, Idea, Knowledge, Method, Mind, Substance, Syllogism, Thought

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LEX NEWMAN

COLVIUS, ANDREAS (1594–1671)

Andreas Colvius, the son of Nicolaas Kolff and Maria Van Slingelandt, was born in Dordrecht. He went to Leiden for theological studies (1612) and then continued his studies abroad elsewhere, including at Geneva (1618). Back in Dordrecht (1619) he became minister in the neighboring village of Rijsoord, where he remained until 1622. In that year he accompanied the first Dutch ambassador to Venice, Johan Berck (1565–1627), as chaplain. He used this Venetian period to meet Italian scholars, like Paolo Sarpi (1552–1623), whose *History of the Inquisition* he translated, and to collect and copy books and manuscripts, like Galileo's *Del flusso e riflusso del mare* (then as yet unpublished). He returned in 1627 and in 1628 received a call as minister to the Dordrecht *Église wallonne* (the Francophone Reformed Church). He retired from the

ministry in 1666 and died July 1, 1671, leaving a rich library and a huge collection of “curiosities.”

Colvius was known as a very learned man interested in philosophy, astronomy, and natural history. Descartes may have known him through **Beeckman**, who was one of his friends. In any case, Descartes’ first letter to Colvius was written in reaction to the announcement of Beeckman’s death (June 14, 1637, AT I 379–80). In November 1640, Colvius drew Descartes’ attention to an Augustinian parallel to the *cogito* (presumably *The City of God* xi, 26) and in April 1643 sent to him some astronomical observations (see AT III 247–48, 646–47). Although Descartes’ Letter to **Voetius** filled Colvius with dismay in June 1643 (AT III 680–81), this did not lead to a break (AT IV 7–8, 717–18). Through his cousin Johan de Witt (1625–72), the famous statesman, Colvius offered **Chanut** copies of the letters he had received from Descartes but the offer was declined because, according to De Witt, Chanut was interested only in those letters Descartes himself had prepared for publication (see Thijssen-Schoute 1967).

See also Beeckman, Isaac; Chanut, Hector-Pierre; *Cogito Ergo Sum*; Correspondence

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THEO VERBEEK

COMMENTS ON A CERTAIN BROADSHEET

Notae in Programma Quoddam is Descartes’ final word in his quarrel with **Henricus Regius**. Regius, who had earned his Utrecht professorship by giving private lessons in **philosophy** and theoretical **medicine**, thought of publishing a compendium of the new philosophy as early as 1641. At that point, Descartes, who obviously did not like that idea, could still dissuade him from doing so. In 1645, however, after Descartes had published the *Principles of Philosophy* (1644), Regius felt free to publish a book on **physics**. Descartes opposed that plan, in part because he did not agree with the views Regius expressed in his initial draft on the relation of **mind** and **body**, the nature of **ideas**, and the idea of **God**. Despite the fact that in the published

version (*Fundamenta physices* [1646]), Regius made some alterations and in the preface declared that, although admiring Descartes and being inspired by him, he alone was responsible for the ideas expressed in the book, Descartes publicly dissociated from him in the preface to the French translation of the *Principia* (1647). He declared that, “as far as physics and **medicine** are concerned, it appears that everything [Regius] writes was taken from my writings.” However, because Regius “had copied inaccurately and changed the order and denied certain truths of **metaphysics**,” Descartes felt “obliged to disavow this work entirely” and “beg [his] readers never to attribute to [him] any opinion they do not find explicitly stated in [his] writings” (AT IXB 19–20, CSM I 189). In reaction to this one of Regius’s students, Petrus Wassenauer (d. 1680), added twenty-one corollaries extracted from the *Fundamenta Physices* (ch. 12, “On Man”). These were to be publicly defended in October 1647 under the supervision of Regius. Moreover, in corollaries 2–3 and 14–15 he also restored the claims Regius had suppressed to humor Descartes concerning the relation between mind and body and the idea of God (AT IV 241–42; AT IV 248–50, CSMK 254–55). Two days before the public defense of Wassenauer’s disputation, it was prohibited by the professors of Utrecht University, not only because twelve of the corollaries gave offense, but also because Wassenauer (whose family members were Remonstrants) dedicated his disputation to a Remonstrant preacher. After an unsuccessful protest, Wassenauer published his corollaries separately in December as a leaflet (*Programma*). Whether he acted entirely on his own or in collusion with Regius is unclear.

Descartes reacted immediately by writing the *Notae*, which was printed, allegedly against his will, in January 1648 (see AT V 114, CSMK 330). The text was preceded by a preface (anonymous, but probably written by the Leiden professor of philosophy **Adriaan Heereboord** [1614–59]) and a verse encomium to Descartes. In the *Notae*, Descartes reproduces the *Programma* (which is lost otherwise) and comments on every claim in detail. The tone is harsh and bitter. The two parts of Regius’s **philosophy** to which he objected most were that we can know that the soul is a **substance** different from the body only by revelation, and that even the idea of God is acquired through “verbal instruction” or “observation.” In reply, Descartes claims that all ideas are in a way innate, even those that concern material objects, because the sense organs “transmit something which, at exactly that moment, gives the mind occasion to form these ideas by means of the **faculty** innate to us” (AT VIIIB 359, CSM I 304). As to the idea of God, he admits that “verbal instruction” and “observation” can be “a remote cause” of our having an idea of God but claims that their role is to “induce us to give some attention to the idea of God,” which itself would come “from no other source than our own faculty of thinking.” Such “ideas, along with that faculty, are innate in us, i.e. they always exist in us potentially” (AT VIIIB 361, CSM I 305) – a formula that is surprising, not only because of the notion of “faculty” (a throwback to **Scholasticism**) but also for the view that an idea is “innate” in the sense that it is in the mind “potentially.” In reply to Regius’s claims

about the relation between mind and body, Descartes draws – more clearly than he does anywhere else – a distinction between “things that are believed through faith alone” (like the Trinity and **transubstantiation**); things that, “while having to do with faith, can also be investigated by natural reason” (like the **existence** of God and the distinction between body and soul); and things “which have nothing whatever to do with faith, and which are the concern solely of human reasoning” (AT VIIIB 353, CSM I 300). At the end, Descartes briefly reacts to the tumultuous atmosphere at Leiden University, where his philosophy had recently become an object of controversy. The *Notae* provoked a rejoinder by Regius (1648), the text of which was preceded by an open letter to Descartes by Petrus Wassenauer (AT V 597–601). The Leiden professor of philosophy Adam Steuart (1591–1654), who is dealt with at the end of the *Notae* (AT VIIIB 365, CSM I 308), reacted too (Steuart 1648), as did Jacobus Revius (1586–1658), whom Descartes also mentions (Revius 1648). Both, however, were more vexed by Heereboord’s preface.

See also Faculty; God; Heereboord, Adriaan; Human Being; Idea; Mind; Regius, Henricus; Substance

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THEO VERBEEK

COMMON NOTION

Descartes’ “common notions or axioms” – the terms are interchangeable in the *Principles* (cf. AT IXB 24, CSM I 209) – derive their name from the *koinai ennoiai*,

later called *axiomata*, which follow the **definitions** and postulates of Euclid's *Elements*. Their conception is classical yet innovative. The idea that some strictly universal and necessary **truths** are both (a) self-evident or immediately clear and distinct for anyone "not blinded by preconceived opinions" (ibid.) and (b) primary in the sense of providing starting points for the **deduction** of other truths is largely traditional; original, on the other hand, is Descartes' bold extension of their use from **mathematics**, logic, and natural science – to which the axiomatic **method** had been applied since antiquity (cf. Blanché 1973) – to **metaphysics** or first philosophy. But if Descartes routinely employed metaphysical *axioms* in his demonstrations, he was nonetheless reluctant to follow *the axiomatic procedure* of drawing logical consequences from a set of intuitively evident general definitions, axioms, and postulates, professing a preference for the analytic method of the *Meditations* over the synthetic method of the geometer (cf. AT VII 155–59, CSM 110–13) (see **analysis versus synthesis**). Still, the *more geometrico* "arguments" he reluctantly agreed to provide as an addendum to the Second Replies are the main source of the common notions listed here (AT VII 160–70, CSM 113–20) (see **Geometrical Exposition**).

Since (a) and (b) characterize Cartesian definitions as well, how do axioms and definitions differ? For one thing, definitions (see those of "**mind**," "**body**," and "**God**" in the Geometrical Exposition) articulate the content of innate **ideas** or *basic concepts* that are not simple and indefinable, like "**thought**," and "**existence**," both of which are best understood simply by experiencing inwardly that one thinks and exists (AT X 524, CSM II 418; cf. AT IXB 8, CSM I 195–96); axioms or common notions, by contrast, are primary *propositions* or innate *truths*. But since a Cartesian **definition** is a proposition or **eternal truth** about the **essence** of the thing defined, this cannot be the whole story. In the *Principles* I.48, Descartes distinguishes "things" (*res*) and their "affections," both of which may exist outside the mind, from *veritates aeternae*, which cannot. The affections include, along with the "principal" **attributes** of thinking and material *res* or **substances**, their respective **modes**. To things, attributes, and modes correspond "notions" in the narrow sense of "concepts." In *Principles* I.49, he subsumes axioms or common notions (in a wider sense of "notion") under the eternal truths. Thus, Cartesian real definitions are eternal truths about substances, about natures that can exist, whereas common notions are eternal truths of a general and abstract kind: indispensable to our reasoning – according to the early *Rules for the Direction of the Mind*, they function as "links which connect other simple natures together" (AT X 419, CSM I 45) – common notions furnish no **knowledge** of anything (capable of) existing outside the mind. In *Principles* I.50, the other term of the pair, "common," is glossed as "common among all people." Without pronouncing them "innate," Descartes says that they "have their seat in our mind," which amounts to the same thing (Gouhier 1969, 271–73).

Similar questions arise concerning common notions, theorems, and principles. In the Geometrical Exposition, Descartes notes that many of his axioms "should

have been introduced as theorems” (AT VII 164, CSM II 116). Was he in doubt about the primitiveness of some of the truths designated common notions? Or does the designation vary with the analytic and synthetic procedures? As for principles, the word is formally defined (cf. AT IXB 2, CSM I 179–80) in terms of (a) and (b). Yet while all common notions are principles, the converse does not hold: the *cogito* is a principle without being a common notion, that is, without being a principle in the same sense as the *non*-existential “Whatever thinks, is” (cf., however, AT IV 444–45, CSMK 290 on the other sense, in which the *cogito* is a principle). While it is not easy to assign a precise extension to every member of this family of terms – which includes “primary notion” (AT VII 135, CSM II 97), “**primitive notion**” (AT III 665, CSMK 218), and “common principle” (AT V 146, CSMK 332) – *collectively* their extension is roughly that of the **simple natures** of the early *Rules*, most of which are expressed by concepts or terms, although a couple of eternal truths feature there as well (cf. AT X 419–20, CSM I 44–45).

At this point, a list of *notiones communes* may be helpful: (1) “Nothing comes from nothing” and its corollary, “what is more perfect cannot be produced by – that is cannot have as its efficient and total cause – what is less perfect.” (2) “It is impossible for the same thing to be and not be at the same time.” (3) “What is done cannot be undone.” (4) “Whatever thinks, is or exists.” (5) “Nothingness possesses no attributes, that is to say, no properties or qualities.” (6) “Things that are the same as a third thing are the same as each other.” (7) “Things that cannot be related in the same way to a third thing are different in some respect.” (8) “The whole is greater than its part.” (9) “Concerning every existing thing it is possible to ask what is the cause of its existence.” (10) “What can bring about a greater or more difficult thing can also bring about a lesser thing.” (See Gouhier 1969, 272–73, for detailed references to these notions.)

This representative sample is not a complete compilation; indeed, the *Principles* declare completeness impossible, there being “countless” common notions (cf. AT IXB 23–24, CSM I 209). Some appear to be metaphysical (those having to do with causality and **existence**), one logical (principle of contradiction), others mathematical (those concerned with **quantity**). But Descartes’ Aristotelian formulation of the principle of contradiction (in terms of being and not-being) tells against applying *our* classificatory schemes to his time. The same danger of anachronism lurks behind the question of whether common notions are analytic or synthetic in Kant’s sense (at least the metaphysical among them – whichever they may be – may be safely considered synthetic). As to whether they are first or primary in the analytic as in the synthetic order, given that they are no more immune to the **doubt** occasioned by the Omnipotent God Hypothesis than are the likewise nonexistential simple truths of **mathematics**, they follow upon the *cogito* in the analytic method of discovery, although they precede all further knowledge so acquired (see **analysis versus synthesis**).

See also Analysis versus Synthesis, Deduction, Definition, Eternal Truth, Idea, Simple Nature, Truth

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MURRAY MILES

COMMON SENSE

Common sense or common sensation – *sensus communis* in Latin – was an innovation of Aristotle (*De anima*, 3.1) adopted by ancient physicians as they assigned physiological locations to psychological powers. Aristotle differentiated the proper sensibles (sense qualities, like color in vision or tone in hearing, that are specific to a single sense) from common sensibles like unity/number, magnitude, **shape**, **motion**, and duration, which appear to more than one sense. Common sensation unites proper and common sensibles in the fully articulated sensory field of ordinary experience. Aristotle located this function near the **heart**, but later Aristotelians quickly adjusted to the consensus of physicians, who placed it in the brain. It was temporally and logically the first of the inner (inward, internal) senses. These included **memory**, **imagination**, the animal ability to quickly "estimate" whether what presented in sense appearances was noxious or good, and even the human capacity to name forms presented in **sensation**.

Having the authority of both Aristotle and physicians, this general schema was almost universally accepted by thinkers and natural philosophers well into the early modern period. It was the psychophysiological basis of Islamic and Western medieval theories that understood cognition as requiring the abstraction of intelligible forms from sense experience. Common sensation receives and unites sensible images of things, called "phantasms." Higher **animals** can retain, reproduce, and process these phantasms by means of memory, imagination, and estimation. In **human beings**, this work of the inner senses "prepares" phantasms for the final step, in which active **intellect** illuminates the phantasms and thereby abstracts from them an intelligible species, which is impressed and preserved in potential (passive, receptive) intellect and produces cognition (see **species**, **intentional**).

Medieval theorists often increased the number of these basic powers by distinguishing and subdividing their functions. Following the existing medical conceptions

about brain location, they distributed them to different locales in the ventricles (the hollows at the base of the brain produced by the anatomical enfolding of the left and right cerebral hemispheres). Sixteenth- and seventeenth-century psychophysiology simplified this scheme by reducing the number of psychological powers to common sensation, imagination, and memory.

Descartes began with this tradition and eventually arrived at his theory of the **pineal gland** as the focus of nerve and animal-spirit functions. Like many physicians, he assigned the psychological powers to organs in the brain rather than to the hollows preferred by late Scholastic philosophers (see **animal spirits**). A first step occurs in Rule 12 of the *Rules for the Direction of the Mind*. He defines the common sense as the part of the **body** that has figures impressed on it by motions coming along the nerves from the sense organs; the nerves transmit a motion, originating from external objects, that has already impressed the same figures on the external sense organs. With respect to the external sense organs, it is like **wax** impressed with the seal of a signet ring. But the common sense can instantaneously transfer its impressions to another body part, the phantasia, the organ of imagination. The *Rules* proceeds to distinguish common sensation from memory and the pure knowing power as well, according to how and where the motion-produced figures are either passed on to other organs and body parts or received and re-formed by the knowing power (*vis cognoscens*). In particular, the knowing power can receive figures from the common sense at the same moment in which they are being impressed in the phantasia. It is through the phantasia rather than the common sense that the knowing power acts upon the rest of the body (e.g., in imagining and remembering, in conscious locomotion, or in directing the attention of the sense organs).

Descartes further radicalized this organic psychophysiology in his later writings, in particular the *Treatise on Man*, part 5 of *Discourse on Method*, *Dioptrics*, and *Passions of the Soul*. He unified the placement of common sensation, imagination, and memory in a single organ, the conarion or pineal gland, which literally became the centerpiece of his doctrine of mind-body interactionism (see **human being**). This gland, located immediately behind the third or middle ventricle of the brain, seemed to Descartes to be the most plausible location for uniting symmetrically the right- and left-side input from the sense organs to the brain. Descartes now also proposed a partly Stoic-inspired pneumatic physiology in which the ventricles and the nerves formed a single system filled with animal spirits. Mechanical impressions on the external sense organs became nerve and spirit motions, which upon reaching the pineal gland chamber moved the gland and produced pressure patterns. In human beings, these motions and patterns were correlated with sensory appearances. In turn, the soul united to the gland could move it and produce new spirit impulses that brought about new psychological or physical events.

Though at first glance it appears that Descartes rejected the sixteenth-century discovery that the ventricles were filled with cerebrospinal fluid, not animal spirits, it is arguable that his “spirit dynamics” applied to both liquids and gases. His theory decisively initiated the era of the cerebral localization of psychological powers in brain organs rather than hollows and conceived neural physiology and psychophysiology as an extension of **physics**.

See also Anatomy and Physiology; Animal Spirits; Imagination; Memory; Pineal Gland; Sensation; Species, Intentional

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DENNIS L. SEPPER

COMPENDIUM OF MUSIC

The *Compendium Musicae* is Descartes’ first book. After meeting **Isaac Beeckman**, he conducted during the last two months of 1618 experiments on musical instruments (including resonance) and exchanged with his friend hypotheses about the nature of consonances and other problems concerning musical theory. The result is a brief treatise that Descartes offers to Beeckman on January 1, 1619, and that is copied, with two other contemporary pamphlets (one on **hydrostatics** and the other on falling bodies) in Beeckman’s diary circa 1628. The *Compendium* was published shortly after Descartes’ death in Utrecht in 1650 from a manuscript submitted by an unidentified “disciple.” This edition served as the basis for subsequent editions. The original manuscript was lost but there are several copies prior to publication that served as the basis for current critical editions (see AT X 79–85 and Descartes 1987).

The structure of the work is similar to classical treatises of musical theory (Descartes mentions only Zarlino by name but indirectly refers to Salinas). Descartes defines the purpose of music and then sets out preliminary principles (*Praenotanda*)

that he applies to the parameters of time and pitch, by treating consonances, scale, and dissonances. At the end he discusses, in a very short practical part, the manner of composing and the musical modes.

The purpose of musical theory is to identify the affections or properties of sound, as far as they may be known mathematically, which are capable of pleasing and of arousing the **passions** (Descartes thus resurrects two of the aims of classical rhetoric). These properties consist in differences in duration (rhythm and meter) and differences in pitch, which may be lower or higher (AT X 89). The qualitative properties of sound (e.g., timbre) are left to the physicist. The *Praenotanda* (AT X 91–92) form a system determining the measurable properties of the sound object from the requirements of the senses regarding proportionality. They clarify what is most pleasant from the search for understanding the object by the senses (which is done with the help of arithmetic proportions) and from the need for a certain variety: the pleasing object should not be too easy to understand, nor too difficult.

These requirements are reflected in the theory of meter, which provides the first known example of Descartes' understanding of the intelligibility of temporal phenomena. Then, in the main part of the treatise, the theory of consonance is treated. Descartes invented a new way to generate consonances from the division of the vibrating string into equal parts by showing that each division by itself produces a consonance and a rest. This allows him to change the accepted order of excellence of the consonances: he places first the octave, then the fifth, but reverses the traditional order by placing the major third before the fourth (considered a "shadow of the fifth"), and also includes sixths among the consonances. Thus, the fourth is not a perfect consonance, as it was still in Zarlino's theory, but an imperfect consonance, while the major third is a perfect consonance (AT X 108). Moreover, Descartes provides experimental confirmation of these points from experiments on resonance using Beeckman's assumptions about the pulses of the vibrating string (AT X 110). This is thus a treatise on music that marks a transition between the mathematical tradition of antiquity and Renaissance and the modern concept linked to the **physics** of vibrations, in the spirit of Beeckman's **physico-mathematics**, but using a significantly different approach.

The theoretical innovation of this juvenile work was noted very early by historians of music theory. However, Descartes did not want this treatise to be published, but in **correspondence** he provided Mersenne with excerpts of the *Praenotanda*, which have sometimes passed for the expression of the "aesthetics of Descartes." The explanation of consonance in the *Treatise on Man* of 1633 (AT XI 150–51) does not work on the same model and does not lead to exactly the same classification. This treatise does not present a real theory of the passions but does have the merit of at least posing the problem.

See also Beeckman, Isaac; Passion; Physico-Mathematics; Physics

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FRÉDÉRIC DE BUZON

CONCURRENCE VERSUS CONSERVATION, DIVINE

On the traditional Scholastic view that has its source in the work of **Thomas Aquinas**, there is a distinction between **God's** "conservation" of the being of an object, which allows that object to continue to remain in **existence**, and his "concurrence" with the action of an object, by which he acts with that object to produce its effect. According to Thomas, God's conservation of an object is merely the continuation of his act of creating that object. The early modern Scholastic **Francisco Suárez** (1967, I 792) expresses this as the claim that there is a mere "distinction of reason" between conservation and creation (see **distinction [real, modal, and rational]**).

Thomas also offers his view of divine concurrence as a response to medieval occasionalists who claim that God is the only real causal agent in nature. There is in Thomas a "causal compatibilism" (this term is from Perler and Rudolph 2000, 154), according to which God operates through secondary **causes** to produce the

effects of those causes. On the one hand, this view allows Thomas to hold, contra the occasionalists, that secondary causes make a genuine causal contribution to the production of their effect. On the other hand, the view allows him to say that this contribution is subordinated to God's contribution to this production as the primary cause of the effects. It therefore differs from the "conservationist" position – defended in the fourteenth century by Durandus of Saint Pourçain – that God's contribution to the natural operations of created agents is exhausted by his creation and conservation of those agents.

Descartes invokes the Scholastic notions of conservation and concurrence in his discussion of God's role in **physics** as "the universal and primary cause of **motion**." In the *Principles of Philosophy* II.36, he holds that God, in his role as primary cause, creates and, "by his ordinary *concursus* alone," conserves a particular total "**quantity of motion**" (AT VIIIA 61, CSM I 240) (see **conservation of motion, principle of**). His account of the divine conservation of the material world is linked to his claim in the Third Meditation that conservation differs "solely by reason" from creation (AT VII 49, CSM II 33). This claim is sometimes taken to indicate that God acts in the material world by "re-creating" it at each moment, where the moments are conceived as distinct "atomic" parts of temporal duration (see **time**). Perhaps the classical source for this "re-creationalist" interpretation is Norman (Kemp) Smith's 1902 text, *Studies in Cartesian Philosophy* (see, e.g., Smith 1902, 73–74). However, it has been picked up in the subsequent French- and English-language literature, and it continues to figure prominently in discussions of Descartes (see, e.g., Gilson 1925, 340–42; Gueroult 1953, I 275; Gabbey 1980, 302 n.40; Machamer and McGuire 2009).

In light of Suárez's development of the Thomistic view of divine conservation, however, a different reading of the Third Meditation claim emerges. For Suárez, the claim that conservation is distinct only in reason from creation indicates that the former consists not in a series of distinct creative acts but rather, as Thomas insisted, in the continuation of the initial act of creation. There is fairly clear evidence that Descartes endorses this Suárezian account of conservation. Thus, in the *Discourse on Method* (1637) he endorses the "opinion commonly received among the theologians" that "the action by which [God] now conserves [the world] is entirely the same as [*toute la mesme que*] that by which he has created it" (AT VI 45, CSM I 133), and later, in *Principles* II.42 (1644), he writes that "the world now continues to be conserved by the same action [*eadem actione*] as created it then" (AT VIIIA 66, CSM I 243; cf. Schmaltz 2008, 81–84).

In the *Principles*, Descartes claims not only that God is the primary cause of motion but also that "rules or **laws of nature**" serve as "secondary and particular causes." There is the view in the literature that this appeal to secondary causes is compatible with an occasionalist physics, according to which God is the causal agent

responsible for the lawlike effects of body-body interactions. For instance, Daniel Garber claims that “it seems to me as clear as anything that, for Descartes, God is the only cause of motion in the inanimate world of bodies, that bodies cannot be genuine causes of changes in the physical world of extended **substance**” (Garber 1993, 12; cf. Garber 1992, ch. 9; Hatfield 1979). According to this interpretation, there is an anticipation in Descartes of the view of his later follower **Nicolas Malebranche** that the laws of motion are simply those “general volitions” of God that produce changes in motion on the occasion of bodily collisions.

Recently, however, other commentators have emphasized Descartes’ use of concurrentist language in his **explanation** of God’s activity as the primary cause of motion. This sort of language is taken to indicate that he accepts a more standard sort of Scholastic concurrentism, according to which God “concur[s]” with the action of bodily causes in producing the effects of body-body interactions (see, e.g., Della Rocca 1999, Pessin 2003, Hattab 2007). Nonetheless, there is a difficulty for this interpretation that derives from the fact that in his defense of concurrentism, Suárez is careful to distinguish God’s act of conservation, which is the continuation of his act of creation, from his act of concurrence, which varies with the different actions of creatures. In contrast, there is no distinction in Descartes between the “ordinary *concursus*” that God contributes as a primary cause of motion and his conservation of the total quantity of motion by means of the same act by which he initially created such a quantity. Descartes therefore suggests the “conservationist” view that divine *concursus* involves merely the creation or conservation of a certain quantity of motion. Changes in motion are to be attributed not to this *concursus* but rather to the bodily “forces” (*vires*) that are said in Descartes’ third law of motion to govern changes in motion due to collision (AT VIIIa 65, CSM I 242) (see **force and determination**). These mutable forces, rather than God’s immutable *concursus*, are particular causes in Descartes’ precise sense of that which produces motion in parts of matter that they previously lacked (see Schmaltz 2008, ch. 3).

See also Cause; Conversation of Motion, Principle of; Force and Determination; Law of Nature; Quantity; Suárez, Francisco; Time

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TAD M. SCHMALTZ

CONIMBRICENSES (COIMBRANS)

Descartes mentions the *Conimbricenses* (in Latin; "Coimbrans" in English) among the textbooks that contributed to his philosophical education (AT III 185, CSMK 154). What he refers to is a set of commentaries on Aristotle (with some complementary pieces) written by a team of **Jesuits** at the University of Coimbra (Portugal) between 1592 and 1606 to provide an authorized version of the **philosophy** courses that were delivered there. The project was initially under the supervision of Manuel de Gois (1542–97), who published the first six parts. He was succeeded by Cosmas de Magalhães (1551–1624). The other contributors were Balthasar Alvares (1561–1630) and Sebastião do Couto (1567–1639) – who wrote alone the entire *Dialectic*.

Commenting on Aristotle, mostly in the form of disputed questions, was the usual way of teaching philosophy in universities since the Middle Ages. The

Jesuits, a teaching order, produced a great number of such textbooks that, officially at least, followed **Thomas Aquinas's** line of interpretation of Aristotle. Taken together, these textbooks would provide a complete curriculum (*cursus*) in philosophy. Such was the intention of the *Conimbricenses*. However, whereas a *cursus* would normally comprise logic, natural philosophy, **metaphysics**, and ethics, the *Conimbricenses* did not include a volume on metaphysics. The Coimbran Jesuit **Pedro de Fonseca's** famous commentary on Aristotle's *Metaphysics* may have made it unnecessary, and, moreover, **Francisco Suárez**, whose *Metaphysical Disputations* were widely influential, also taught at Coimbra. Thus, the *Conimbricenses* (eight parts in five, in-quarto volumes) include a volume on Aristotle's logic (*Dialectica*, published last); commentaries on Aristotle's *Physics*, *On the Heavens*, *On Generation and Corruption*, *Meteors*, *On the Soul*, and *Short Treatises on Nature* for the natural philosophy section; and a commentary on the *Nicomachean Ethics*. Because of their quality, the *Conimbricenses* were best sellers, even in Protestant countries, and were republished many times in the seventeenth century. Like other Jesuit textbooks, they came to represent the quintessential "philosophy of the School" (see **Scholasticism**). They were undoubtedly important in Descartes' education and are essential for understanding his vocabulary and the Scholastic ideas he eventually either rejected or conserved. When he decides in 1640 to reread some Scholastic philosophy to prepare his counteroffensive against the Jesuits (and to prepare to write what became the *Principles of Philosophy*), Descartes finds that the *Conimbricenses* corpus is too voluminous for his purpose. The textbook he finally chose as representative of Scholastic thought is **Eustachius a Sancto Paulo's** *Summa quadripartita*.

See also Bourdin, Pierre; Eustachius a Sancto Paulo; Jesuit; Rubius, Antonius; Scholasticism; Suárez, Francisco; Toletus, Franciscus

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JEAN-LUC SOLÈRE

CONSERVATION OF MOTION, PRINCIPLE OF

In his *Principles of Philosophy* (1644), Descartes claims that the total **quantity** of **motion** remains constant in all natural change, where the quantity of motion is measured by the product of the volume of a moving **body** and the speed of its motion (and where the latter is a scalar quantity that does not include directionality). Even though the quantities of motion in particular parts of matter can change because of collision, according to his principle of the conservation of motion the sum total of all of these quantities remains constant. Descartes' argument for this principle appeals to the fact that **God**, in acting as "the universal and primary **cause** of motion," and in virtue of his immutability, conserves the material world "in the same way and by the same plan [*ratione*] that he first created it" (*PP* II.36, AT VIIIA 62, CSM I 240). The immutability of the divine conservation of the material world is supposed to ensure the constancy of the total quantity of motion in all changes brought about by collision (see **cause** and **concurrence versus conservation, divine**).

There is the influential claim in Pierre Duhem that the modern emphasis on the conservation of motion has its roots in the late Scholastic theory of impetus. According to this theory, the continuing motion of a body derives from an

“impetus” that the mover imparts to the body. Duhem (1955, 34–53) takes the conclusion in Descartes and other seventeenth-century mechanists that motion is conserved in all natural change to be anticipated in the claim in the Scholastic master John Buridan that this impetus in bodies is “something permanent in nature.” However, Anneliese Maier (1982, 89–91) has noted in response that Buridan proposed the permanence of the impetus only in the case of celestial motion and allowed that, in the case of terrestrial motion, impetus is opposed by contrary tendencies in bodies. Indeed, **Francisco Suárez** (1967, 1:801), a sixteenth-century Scholastic proponent of impetus theory, emphasized that when an impetus is impressed on a body, “there is no requirement that it be conserved there permanently,” inasmuch as, “because in other respects the subject of the quality is always resisting it and its action, the nature of such a quality requires that it should stop being conserved little by little.” It seems, then, that Descartes’ conservation principle is a marked departure even from the sort of impetus theory that Duhem highlights.

However, Descartes’ emphasis on the fact that it is quantity of motion that is conserved led him to offer empirically inadequate collision rules. His rules were widely criticized in the early modern period, most notably by **Gottfried Wilhelm Leibniz**. Leibniz argued that what is conserved in collision is not Descartes’ quantity of motion but rather the product of the mass and the square of the velocity (a vector quantity that includes directionality), or mv^2 , which he called *vis viva* (living force). Descartes still had his defenders, however, and Leibniz’s argument triggered an intense controversy over *vis viva*.

See also Cause; Concurrence versus Conservation, Divine; Law of Nature; Motion; Quantity

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CONTAINMENT, EMINENT VERSUS FORMAL

In the Third Meditation, Descartes proposes the following as “manifest by the light of nature”: “There must be at least as much in the efficient and total **cause** as in the effect of that cause” (AT VII 40, CSM II 28). Elsewhere he labels this as the “axiom or **common notion**” that “whatever is of reality or perfection in some thing is formally or eminently in the first and adequate cause of it” (AT VII 165, CSM II 116).

This “containment axiom,” including its appeal to the “formal or eminent containment” of the reality of an effect in its “efficient and total cause,” is straight from the Scholastic tradition. Descartes himself offers technical **definitions** of the two different kinds of containment, noting that things “are said to be *formally* in the objects of **ideas**, when they are such as we perceive them [*talia sunt in ipsis qualia illa percipimus*], and *eminently*, when they are not such [as we perceive], but so great that they can take the place of such things [that are such as we perceive] [*quando non quidem talia sunt, sed tanta, ut talium vicem supplere possint*]” (AT VII 161, CSM II 114).

In the case of formal containment, the definition has a distinctively mentalistic cast, as reflected in its reference not only to what is in the “objects of ideas” but also to features of objects that are “such as we perceive them.” This connection between our **perceptions** or ideas and their objects is further mediated by the objective reality of an idea, which Descartes defines – just before defining formal and eminent containment – as “the entity of the thing represented by the idea [*entitatem rei repraesentatae per ideam*], insofar as it is in the idea.... For whatever we perceive as in the objects of ideas, they are in the ideas themselves objectively” (AT VII 161, CSM II 113–14) (see **being, formal versus objective**). For Descartes, then, the paradigmatic case of formal containment is one in which the entity as it exists outside of our idea is “such as” the reality insofar as it is represented by our idea.

Descartes’ definition of eminent containment indicates that this sort of containment is supposed to accommodate cases where the cause differs in nature from its effect, and so cannot contain this effect “such as we perceive it.” However, this definition does not fit very well his own example in the Sixth Meditation of this sort of containment. In this text, Descartes considers the containment of the objective reality of our sensory ideas either in **God** or in something “nobler than **body**,” namely, some finite thinking thing. With respect to this example, it is not the case that what is eminently contained in the object of our idea is something so great that it can take the place of what we perceive in the object. For one thing, the objects that contain the reality of our sensory ideas are neither God nor things nobler than body, but rather bodies themselves. Bodily qualities are supposed to be eminently

contained in some object that differs from the objects of our sensory ideas insofar as that object has features that are “so great” that they can “take the place of” such qualities.

This example seems to indicate that eminent containment paradigmatically involves the ability of God’s infinite **mind** to contain creatures and of finite minds to contain bodily objects. One suggestion here is that though God cannot formally contain features of creatures, and finite minds cannot formally contain features of the material world, still they have the power to represent these features in thought. There is textual evidence for attributing this sort of view to Descartes in one of the rare texts outside of the *Meditations* in which he discusses eminent containment. This text is from an exchange with his pseudonymous critic **Hyperaspistes**. This critic objected that in Descartes’ view, “since a corporeal thing is not nobler than the idea that the mind has of it, and mind contains bodies eminently, it follows that all bodies, and thus the whole of this visible world, can be produced by the human mind” (AT III 404). Such an implication is said to be problematic insofar as it undermines our confidence that God alone created the visible world. In response, Descartes does not dispute that our mind eminently contains the visible world but only protests that we can produce “not, as objected, the whole of this visible world, but the idea of the whole of things that are in this visible world” (AT III 428, CSMK 193). The indication here is that the whole visible world is eminently contained in our mind in the sense that we have the power to produce the idea of this world. In applying this suggestion to the example in the Sixth Meditation, we have the view that minds can eminently contain bodily qualities in virtue of the fact that they have the power to produce the reality present objectively in our sensory ideas of those qualities (for more on Descartes’ notions of formal and eminent containment, see Schmaltz 2008, 64–71; cf. the different interpretations of eminent containment in Clatterbaugh 1980 and O’Neill 1987).

See also Being, Formal versus Objective; Cause; Common Notion; Hyperaspistes

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TAD M. SCHMALTZ

CONVERSATION WITH BURMAN

Discovered in 1895 in Göttingen and published the following year by Charles Adam, the manuscript entitled *Descartes' Conversation with Burman* – a report of an interview with Descartes by **Frans Burman** – is a text whose status and legitimacy have always been subjected to debates among commentators. The manuscript is a copy made by an anonymous hand of a text by **Johannes Clauberg** to whom the first notes, taken probably by Burman, were sent four days after the interview on April 16, 1648. It is likely that between Clauberg's copy and the Göttingen manuscript at least one other copy was made. The Duisburg teacher also reproduced some passages from the *Conversation* in his own works (*Defensio cartesiana adversus Jacobum Revium*, *Initiatio philosophi sive Dubitatio cartesiana*, and *De cognitione Dei et nostri*). Christoph Wittich (1625–87) also alludes to a passage from the conversation in his *Annotationes Renati Des-Cartes Meditationes*.

The mystery surrounding the drafting and the transmission of the text, and the suspicions of corruption that are normally associated with the very conditions of the interview, which may have taken place while the philosopher was at table (AT V 148, CSMK 335), have stimulated doubts concerning the reliability and authenticity of a text in which the different voices (Burman's and Descartes') cannot always be clearly distinguished. Adam (1910, 484) first stressed that we should not take Descartes' statements too "literally." Ferdinand Alquié (1973, 766–67) did not include the *Conversation* in his edition of Descartes' *Œuvres philosophiques* because in his view it consisted of "table chats" and at times was inconsistent with the philosopher's thought.

Since the beginning of the twentieth century, three types of work concerning the *Conversation* followed one another, sometimes overlapping. The first efforts were directed at reconstructing dialogue (Adam 1910). Then attention turned to the relation between the statements attributed to Descartes and the rest of his work (Cottingham 1976 and Beyssade 1981). Finally, Adam's reading of the manuscript was checked and compared with the excerpts found in the works of Dutch Cartesians (Arndt 1982 and Savini 2004). The question remains whether the text can be used only to confirm statements made in other works written by Descartes' hand or whether it constitutes an original work in its own right (Beyssade 1981, 158).

A more fruitful approach is to situate Burman's interview in his historical context. Instead of explaining Burman's questions as the result of a careful reading by a gifted young student, they show an awareness of the objections raised against Descartes' philosophy in the Dutch universities. In fact, it is not unlikely that they proceed from a discussion of those difficulties among Cartesians who were anxious to learn from the philosopher himself how they should respond to them. More particularly, the problems raised in the *Conversation* can be traced back to **Gysbertus Voetius's** *Selectarum disputationum theologicarum* (published in late 1647) and to the theses against Descartes defended at Leiden University under the authority of Jacob Revius (1586–1658), Adam Stuart (1591–1654), and Jacob Trigland (1583–1654). Accordingly, the text throws a special light on the first stages of Dutch **Cartesianism**

as it developed more particularly at Utrecht and Leiden. Therefore, although the statements attributed to Descartes must be taken seriously, they cannot be fully understood without taking into account the specific circumstances of the interview and the historical context (Kieft 2009).

As for its philosophical content, the *Conversation* covers a range of important topics, including the method of **doubt**, the **Cartesian Circle**, the relation between a **substance** and its **attributes**, the status of innate **ideas**, and the nature of **memory**. If we take this work to be an accurate report, Descartes elucidates the denial in his published writings that the *cogito* is a **sylogism**. We learn for the first time that the **mind** is capable of thinking of multiple things at once. He also explains why he reverses the order of his theistic proofs in the move from the *Meditations* to the *Principles*. Moreover, Descartes indicates just how strongly he understands the doctrine of divine simplicity: the distinction between **God** and his decrees is merely conceptual. He also reaffirms a point whose explicit expression is confined to the **correspondence** and that is only implicit in the *Principles* – namely, that there is only a conceptual distinction between **essence** and **existence** in all things, thus rejecting the Thomistic theory of real distinction (see **distinction [real, modal, and rational]**).

See also Burman, Frans; Cartesianism; Clauberg, Johannes; Voetius, Gysbertus

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XAVIER KIEFT

CONWAY, ANNE (1630?–1679)

Lady Conway (née Finch) was one of the very few women philosophers of the seventeenth century. She studied Cartesian **philosophy** with the Cambridge Platonist **Henry More**, who translated Descartes' *Principles of Philosophy* especially for her. Barred from attending university because she was a woman, she studied by correspondence. She was thus exposed to both More's enthusiasm for Descartes and his critique of **Cartesianism**. She published nothing in her lifetime, but her posthumously published *Principia philosophiae antiquissimae et recentissimae* (1690) (English trans., *The Principles of the Most Ancient and Modern Philosophy*, 1692) rejects the Cartesianism of her philosophical education. Notably, she argues that on Descartes' **definition of mind** and **body** it is impossible to account for interaction between them. Furthermore, it is contradictory to suppose that **God** as a perfect living being, would create a **substance** so unlike himself as body as conceived by Descartes. These objections lead her to posit a monism of substance, where all things consist of living particles, which she calls monads. She outlines a Neoplatonic hierarchy of being in which all things derive from God by a process of continuous emanation. Her critique of Cartesian **dualism** is tempered by her acknowledgment of Descartes' achievement in elucidating the laws of mechanical **motion** (see **law of nature**). The work registers the influence of Francis Mercurius Van Helmont, who brought it to the attention of **Leibniz**.

See also Cartesianism; Dualism; Human Being; More, Henry; *Principles of Philosophy*

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SARAH HUTTON

CORDEMOY, GÉRAUD DE (1626–1684)

Born in Paris, Cordemoy served as a lawyer in the Parlement of Paris, but he was also active in the philosophical conferences of the French capital, including those of Emmanuel Maignan (1601–76) and **Jacques Rohault** (1618–72). His major works are *Le discernement du corps et de l'âme en six discours pour servir à l'éclaircissement de la physique* (1666) and *Discours physique de la parole* (1668). In 1673 he was appointed tutor to the dauphin, and in 1683 he became director of the Académie française, having been elected a member eight years earlier. He died October 15, 1684. Cordemoy's importance to **Cartesianism** in particular and to seventeenth-century thought in general results chiefly from three factors. First, he is the only Cartesian atomist. Cordemoy arrives at atomism from what he takes to be the logical consequence of a Cartesian understanding of **substance** (see AT VIII A 24–25, CSM I 210). Substances, he claims, are essentially metaphysically simple, and for extended substance, this implies atomism. So for him, it is not merely a contingent physical fact that the corporeal world is at root composed of **atoms**, or **bodies** (*les corps*, assemblages of which constitute matter); it is a metaphysical requirement, given a clear and distinct understanding of the concept of substance. Second, Cordemoy is one of the first, if not the first, of Cartesian philosophers to argue that Descartes' **metaphysics** demands an occasionalist understanding of causation. Beginning with "interaction" between bodies, and then extending his analysis to body-mind and mind-body "interaction," Cordemoy argues that only **God** could be the **cause** of the effects generated in such instances. He begins his argument by taking as axiomatic that nothing can lose something essential to it without ceasing to be what it is. As bodies can lose their **motion**, motion cannot be for them an essential property. Further, as motion is a **mode** of bodies, and because Cartesian metaphysics does not permit a particular token mode to be transferred to another substance, bodies cannot give each other motion. Only something that itself is not a body could be the cause of motion in bodies. Cartesian ontology contains only **minds** and bodies, and so the cause in question must be a mind. Reflection shows that our own finite minds are not the cause of motion in bodies. Once it is further posited that (a) moving is an action,

and (b) an action can be continued only by the agent that initiated it, we get God as the cause of all motion. As for interaction between minds and bodies, Cordemoy accepts the Cartesian view that **human beings** are the union of distinct substances with mutually exclusive **essences** (see AT VII 78, CSM II 54). This being the case, he argues, we must look outside of that union to account for the effects in one on the occasion of the actions of the other. Finally, although it does not receive much attention today (relative to his atomism and occasionalism), Cordemoy was known in his day mostly for his account of speech, which he builds on the basis of Descartes' claim in the *Discourse on Method* that **language** use is a sign of a rational mind and thus an ability that only humans possess (AT VI 56–57, CSM I 139–40).

See also Atom; Body; Cartesianism; Cause; God; Language; Mind; Mode; Motion; Rohault, Jacques; Substance

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FRED ABLONDI

CORRESPONDENCE

Like most seventeenth-century intellectuals and scholars, Descartes entertained a correspondence, letters being in this period the main channel for the communication of scientific news. Letters were often shared with others, and this was one of the reasons why their authors usually kept an archive of *minutes*, first drafts, or full

copies. In Paris and other centers of learning, there were mostly informal circles of friends (often called “academies”), in which letters were read and discussed on a weekly or even a daily basis. Usually they constitute an essential part of a philosopher’s or scientist’s legacy, not only because they illuminate the various stages through which an idea passed before being known to the public, but also because they give insight into, for example, secret or immature thoughts or discarded plans. All of this can also be said of the correspondence of Descartes, whose letters serve by and large the same purpose as those of other philosophers and scientists of the period – to react to news and gossip, to discuss plans, to propose and solve problems, to deal with objections, and to discuss and communicate data. However, in some respects his correspondence is peculiar. First of all, by its quantity: the volume as we know it (and much of it was lost) is almost twice that of his published works and four times that of his posthumous works. Moreover, although Descartes was in contact with many of his contemporaries, few people wrote to him directly: most of the French correspondence passed through the hands of **Mersenne**. Finally, the way in which Descartes’ correspondence survives poses an enormous challenge.

Before leaving the Low Countries in the autumn of 1649, Descartes entrusted **Cornelis Van Hogelande** with a trunk containing letters and papers, instructing him that these should be burned in the event of his death. Presumably, these were mainly letters written to Descartes since he took the minutes of his correspondence and his unpublished manuscripts with him to Sweden. Whether Van Hogelande did burn the letters we do not know. In one case (that of **Constantijn Huygens**), it is certain that he restituted the letters to their sender. After Descartes’ death, an inventory was made of his possessions. **Chanut**, the French ambassador in whose house Descartes died, sent personal belongings to the Descartes family but kept his scientific writings, including the general correspondence. His first intention was to publish Descartes’ exchanges with **Queen Christina**, **Princess Elisabeth**, and himself – a plan also entertained by Descartes himself, possibly at the instigation of Chanut (see Letter to Elisabeth, March 31, 1649, AT V 331; cf. Letter to Chanut, November 20, 1647, AT V 86). This plan failed because Elisabeth refused her consent and asked for her letters back (see the letters of Chanut to Elisabeth of February 19 and April 16, 1650, AT V 471–72). Nothing happened presumably until the end of 1653, when Chanut was on a diplomatic mission in The Hague, where he sought the help of **Christiaan Huygens**, the famous physicist, whose father Constantijn had himself been a friend and correspondent of Descartes, to make a thorough examination of Descartes’ letters and papers. The inventory resulting from it is probably what is known as the “Stockholm inventory” (AT X 4–12). According to a letter of Johan de Witt (1625–72), the Dutch statesman, to his cousin **Colvius**, who had offered his own correspondence with Descartes, Chanut’s plan at that point was to publish those letters only “which Monsieur des Cartes kept with him and, when still alive, arranged in such a way that it is fairly clear that he intended to have

them published at some time” (see Thijssen-Schoute 1967). Also according to De Witt “some of these letters” were already being printed. This may have been a false rumor, but it is also possible that Chanut had already sent part of Descartes’ letters to his brother-in-law, **Claude Clerselier**.

Clerselier started work on an edition at any rate in the first half of 1655. He faced a difficult task, given that, apart from the letters already prepared for publication, he had only a few of the letters written to Descartes and in many cases no more than the *minutes* of the letters written by Descartes. These had often been penned in haste, normally they were not dated, and it was not always clear to whom they were written. Clerselier made a selection, did his best to restore dates and identify correspondents, and retrieved part of what seemed to be lost. **Morin**, for example, and **More** gave him copies of their correspondence with Descartes. Others, however, like **Regius**, categorically refused all cooperation. The letters to Mersenne, which would have allowed Clerselier to work out a reliable time frame, were in the possession of **Gilles Personne de Roberval** (1602–75), who also refused to cooperate. Despite all those difficulties Clerselier managed to edit three volumes of letters, published between 1657 and 1667. They contain a total of 372 letters. A Latin edition of the same collection was published in the Netherlands in 1668, the texts being prepared by an unknown editor, possibly in consultation with Clerselier.

After the death of Roberval in 1675, Descartes’ letters to Mersenne came into the possession of the Académie des sciences (Roberval had been among the first members), which commissioned one of its members, the mathematician Philippe de La Hire (1640–1718), to examine them and, if found important enough, prepare an edition. La Hire classified them by date and found that in many cases Clerselier’s edition could be substantially corrected. Meanwhile, Clerselier died (1684). In his will he left a large sum to a certain Abbé Jean-Baptiste Legrand – someone of whom very little is known – who should use the money to prepare an edition of Descartes’ unpublished papers. Having realized, however, through the efforts of La Hire that Clerselier’s edition of the letters could considerably be improved, Legrand planned also a renewed and more complete edition of Descartes’ letters. Moreover, he collected material for a biography of Descartes (which eventually would be written by his friend **Adrien Baillet**). However, Legrand died before his plans could be realized, which is unfortunate because his efforts led La Hire to abandon his own project.

Apart from Baillet’s biography, which contains quite some references to unpublished correspondence, the most palpable traces of Legrand’s work can be found in a copy of the Clerselier edition, now in the possession of the Institut de France and known as the *Exemplaire de l’Institut*. This contains notes and corrections, mainly on the basis of a comparison of Clerselier’s text with the original letters to Mersenne, as they were classified by La Hire. Until Victor Cousin (1792–1867), who between 1824 and 1826 published a new edition of the works

of Descartes in eleven volumes (volumes 6–10 being devoted to the correspondence), nothing much happened apart from a reprint of the Clerselier edition in six volumes (1724–25). Cousin knew the *Exemplaire de l'Institut* and used it occasionally to correct the text of Clerselier, but he does not seem to have realized that the original letters of Descartes to Mersenne were still in the possession of the Institut de France – the umbrella organization of French national academies. This proved to be very unfortunate, given especially the clandestine activities of a mathematician and book collector, Count Guglielmo Libri Carucci dalla Sommaja (1803–69), who used his position as inspector of the French libraries to steal many thousands of rare books and manuscripts – among them more than seventy letters of Descartes to Mersenne. Before this was discovered and a warrant issued for his arrest (1848), Libri managed to escape to England, carrying with him sixteen large trunks with books and manuscripts. Much was auctioned and sold to private collectors. Descartes' letters to Mersenne were dispersed.

Toward the end of the nineteenth century, Cousin's edition was replaced by what became the standard edition of Descartes' works by Charles Adam (1857–1940) and Paul Tannery (1843–1904) in eleven volumes, with a biography (by Adam) and a supplement (1897–1913). In this edition, the first five volumes are devoted to the correspondence. Tannery retrieved quite a few of Descartes' original letters. Moreover, the information the new editors had at their disposal was much more detailed than Cousin's, and they also made a more systematic use of Baillet and of the *Exemplaire de l'Institut*. Finally, the project led many historians and collectors to come forward with new findings. As a result, the number of letters in this new edition increased dramatically to almost six hundred. Even so, an important part was still missing, particularly the correspondence with Constantijn Huygens, of which Adam and Tannery knew only a few minutes. After being auctioned in 1825 by a descendant of Huygens, C. A. Van Sypestein (1785–1841), the letters to and from Descartes disappeared from the view until the beginning of the twentieth century, when they were rediscovered by the anthropologist L. H. Dudley Buxton (1889–1930), then still a boy, among the papers of a relative, Harry Wilmot Buxton (d. 1880). Not only were they a substantial addition to the collection published by Adam and Tannery (109 original letters to and from Descartes, a few letters to and from Van Surck, as well as documents concerning **the Stampioen affair**); they also provided a reliable time frame for redating many other letters. The publication of the letters in 1926 by Leon Roth (1896–1963) led Charles Adam to reconsider the chronology of Descartes' correspondence in his own edition. He published his conclusions in an article in the *Revue philosophique de la France et de l'Étranger* (1933), which was followed by a new edition of the correspondence in cooperation with Gérard Milhaud, in eight volumes (1936–63). This edition, however, was not critical and contained little historical information – in fact, the best way to use it is in combination with the original Adam and Tannery edition.

In the 1960s, it was generally realized that the Adam and Tannery edition was no longer adequate and often misleading. On the other hand, it would take years, if not decades, to produce an alternative. As an emergency solution it was decided to reissue it as it was, with the addition, however, at the end of each volume, of a reprint of the discoveries made after 1913 as well as critical notes, written mainly by the various editors of the *Correspondance de Mersenne* (18 vols., 1932–88). This new Adam and Tannery edition was published between 1964 and 1976 and reprinted on a smaller format in 1996. Although this is a considerable improvement as compared to the previous situation, most readers find this latest edition difficult to handle, not only because the chronological sequence of the letters is interrupted but also because the errors and mistakes of the original edition are still there, even if at some, not always predictable, place they are often corrected. Moreover, recent studies show that by taking into account the actual context of the letters many of them can be dated in a more precise way (Bos 2010, Descartes 2003, Regius 2002). Finally, since 1971 (the date until which new discoveries and scholarship were taken into account by the new Adam and Tannery edition) letters occasionally turned up at auctions or emerged from the manuscript collections of libraries and private individuals. Many of the letters to Mersenne originally stolen by Libri could be retrieved, the most spectacular find of recent years being a letter to Mersenne of May 27, 1641, which was known only by a reference in Baillet and turned out to contain many unknown details on the publication of the *Meditations*. Finally, Italian and French scholars published a reproduction of the *Exemplaire de l'Institut*. Thanks to these collective efforts a new and considerably improved edition of the correspondence has become a real possibility.

Again, Descartes' correspondence served more or less the same purpose as that of other philosophers and scientists of the period. Arguably it is of even greater importance than in most other cases, not only by its quantity but also because for Descartes, who lived in relative isolation, letters replaced the day-to-day discussions with scholars and intellectuals that would have been possible in Paris. As a result, his correspondence can be seen as an "intellectual laboratory." Not only does it make it possible to follow the evolution of Descartes' thought; it also reveals, for example, his solutions to problems proposed by **Fermat**, his answers to the numerous questions discussed in the circle of Mersenne (which Mersenne forwarded to him regularly), his remarks on draft disputations of Regius, and his answers to questions and queries – most of which never found their way into Descartes' works. It is also a laboratory in the more practical sense that it was often the main channel for the communication of observations (which could be rare) and **experiments** (which were often expensive or required the assistance of many others). The correspondence, much more than the published works, reveals how essential they were to Descartes' project. And thus we find in Descartes' letters his reactions to experiments realized or proposed by Mersenne, descriptions of experiments suggested by himself, results

of his own observations and experiments, and reactions to the **vacuum** experiments of **Pascal**.

It is also through the correspondence that we know of the history of Descartes' works: the *Discourse* and the *Meditations* (and how they became different from what they were planned), *The World* (and how it was held back at the end of 1633), the *Treatise on Man* (and how it developed until the beginning of the 1640s), and the *Passions of the Soul* (and how it grew out of his correspondence with Princess Elisabeth). It is through Descartes' letters to Ferrier and Huygens that we have detailed knowledge of the evolution of Descartes' design of a **machine** for grinding hyperbolic lenses (how it continued after the *Dioptrics* and was eventually abandoned) and of the details of the crises over Descartes' **philosophy** at the universities of Utrecht and Leiden. It is through the correspondence that we learn something of Descartes' complex personality; of his strategies as an author; of his thoughts on enemies like Roberval, **Beaugrand**, **Petit**, **Voetius**, **Schoock**, and Revius, or friends like **Beeckman**, Ferrier, and Regius (and how these relations turned sour); of his relations with patrons and would-be patrons like Princess Elisabeth and Queen Christina or Huygens and De Wilhem; of his expectations (and disappointments) with respect to the Sorbonne, the **Jesuits**, and the church. It is also through the letters that we sometimes have a glimpse of Descartes' day-to-day business and of his personal relations. We see him dissecting rabbits and eels (Letter to Plempius, February 15, 1638, AT I 526–27; March 23, 1638, AT II 66), visiting the Leiden anatomical theater (Letter to Mersenne, April 1, 1640, AT III 49), being involved in the treatment of a young girl suffering from rickets (Letter to De Wilhem, June 13 and 24, 1640, AT III 91–93), soliciting an interview with the stadholder for two Haarlem priests (Letter to Huygens, October 1639, AT II 583–86), and pleading the case of a murder suspect (Letter to Huygens [?], January 1646, AT V 262–65).

Finally, there are many parts of Descartes' philosophy that, since they never found their way to a publication, would never be known without the correspondence or, if they did find their way, are more fully explained. To the first belong not only Descartes' political ideas, which are known only through his reactions to Machiavelli (Letter to Elisabeth, September 1646, AT IV 486–92) and Hobbes (Letter to [?], 1643, AT IV 67), and his ideas on **medicine** and chemistry through a letter to **Newcastle** (April 1645, AT IV 188–92); but also his doctrine of the creation of **eternal truths** (Letter to Mersenne, April 15, 1630, AT I 145–46; May 6, 1630, AT I 149–50) and his **explanation of transubstantiation**, as it evolves through his correspondence with **Mesland**. To the second belong, for example, Descartes' ideas on **animal machines**, which, although it is mentioned in the *Discourse* (AT VI 56–57), is further developed and refined in his correspondence with **Fromondus**, **Newcastle**, and **More**.

See also Animal; Baillet, Adrien; Cavendish, William; Chanut, Hector-Pierre; Clerselier, Claude; Elisabeth, Princess of Bohemia; Eternal Truth; Experiment;

Hogelande, Cornelis Van; Huygens, Constantijn; Machine; Mersenne, Marin; Mesland, Denis; More, Henry; Regius, Henricus; Roberval, Gilles Personne de; Schoock, Martinus; Transubstantiation; Voetius, Gysbertus

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COSMOLOGICAL ARGUMENT

Descartes' cosmological (or causal) arguments for the **existence** of **God** are often thought to be among the least plausible aspects of his **philosophy** and, perhaps as a result, have been relatively neglected by commentators. But these arguments are as important to his epistemic project in the *Meditations* as they are controversial. Having proven in the Second Meditation that he exists as a thinking thing, the meditator aims in the Third Meditation to discover whether anything outside of him exists. Before philosophizing, he had judged that there are physical objects that **cause** his **sensations**, and that these sensations resemble their causes, but he now recognizes that such **judgments** are based on "blind impulse" and thus untrustworthy (AT VII 38–40, CSM II 26–27). Descartes will eventually develop a proof of the existence of **bodies** (in the Sixth Meditation), but he postpones that here, turning his sights on the more ambitious project of demonstrating God's existence (see **body, proof of the existence of**). His goal is not just to overcome solipsism but to chart a course that will enable him to dispel the hyperbolic **doubts** of the First Meditation – most notably, the "omnipotent deceiver hypothesis" – by proving that he was created by an all-perfect being who would not deceive him.

Descartes presents two theistic proofs in the Third Meditation, though most commentators treat the first as the main argument, and in a letter Descartes asserts that the two arguments are "reducible to one" (AT IV 112, CSMK 232). Given these considerations and the constraints of space, the main focus here will be on the first argument. The main problem with this argument is that it relies on seemingly bizarre principles of causality and antiquated doctrines about degrees of reality and different kinds of being, which have their source in Neoplatonism and **Scholasticism** and do not seem to be a good fit within Descartes' own metaphysical system. How can such principles enable us to achieve **knowledge** if they themselves are so dubious? In the *Objections and Replies*, Descartes responds to several criticisms of his arguments. He also reformulates his cosmological arguments in the **Geometrical Exposition** and in the *Principles* (1644), though he presents them there *after* the **ontological argument**, reversing the order he had followed in the *Meditations*, leaving commentators to debate the significance of this reordering.

1. THE FIRST COSMOLOGICAL ARGUMENT

Perhaps it is not so surprising that Descartes' first theistic proof in the *Meditations* is a cosmological argument (broadly speaking) since arguments of this kind were the stock-in-trade of Scholasticism. Descartes hoped his own philosophy would supplant the latter, but he also realized that he was writing for an audience steeped in that

tradition and so must exploit Scholastic intuitions if he was to succeed. Nevertheless, his versions of the argument differ in important ways from those found, for example, among **Saint Thomas Aquinas's** famous "Five Ways" (Descartes' first causal argument is often compared to Aquinas's "Second Way"). Traditionally, cosmological arguments proceeded from some "effect" known through the senses, such as the existence of the cosmos (hence the term "cosmological" argument). Descartes' meditator, however, doubts the reliability of his senses. But as a thinking thing, he knows that he has various **ideas**, among them the idea of God. One can doubt whether the objects of one's ideas exist, but not whether one has a particular idea with a determinate content. For example, one can be mistaken about whether there are unicorns in the world, as that involves judgment, but not that one has an idea of unicorn (AT VII 37, CSM II 26). Thus, given the meditator's limited epistemic resources, Descartes' first cosmological argument proceeds from the idea of God and the second from the meditator's own existence as a thinking thing.

The cosmological argument is often referred to as a "causal" argument because it hinges on a causal principle such as "everything has a cause." Descartes sometimes invokes this principle in this context, but because he is writing for a Scholastically trained audience, he avails himself of more complex causal principles. To understand them, let us first examine their two metaphysical underpinnings: the scale of reality; and the distinction between two kinds of being, formal and objective. One basic assumption of Descartes' predecessors is that being or reality is scaled or admits of degrees. This doctrine has its roots in Plato and Aristotle, but medieval defenders countenanced a continuous scale of reality from inanimate objects all the way up to God, with plants, animals, humans, and angels falling in between. In a simplifying move characteristic of his **metaphysics**, Descartes recognizes only three discrete levels: God or infinite **substance**, finite substances (i.e., created **minds** and bodies), and **modes**. In assuming that reality is scaled in this way, he is not presupposing that God actually exists, for that would beg the question. Rather, the claim is that *if* God exists, then he enjoys an infinite degree of being. These are three *categories of being*.

The second doctrine that informs Descartes' causal principles is the distinction between two kinds of **being, formal versus objective**. The terms "formal" and "objective" are taken from the Scholastics and are confusing to modern readers, in part because they have misleading connotations in English, but there is a simple way of understanding them. The first is another term for actual existence – the everyday, garden variety. Everything on Descartes' scale of being, if it exists, enjoys formal being: God, created minds and bodies, and even the *idea* of God (which is a mode of the meditator's mind). But Descartes holds that ideas are unique in that they also enjoy *objective being*, by which he means the kind of reality that ideas have in virtue of their representational character. Ideas, he repeatedly reminds us, are like pictures or images and, as such, represent or literally "exhibit" (*exhibere*) various things to us

(AT VII 37, CSM II 25). Descartes concedes that objective existence is an attenuated form of reality, as compared to formal being, but insists nevertheless that it is “not nothing” (AT VII 41, CSM II 29). This last point is crucial to the cosmological argument because he argues that the idea of God, considered not just in terms of its formal reality *but also in terms of its objective reality*, must have a cause. Ideas considered formally all share the same degree of reality (viz., that of a mode), but considered objectively, their degree of reality varies depending on whether they represent a mode, a finite substance, or God (AT VII 40, CSM II 27–28).

Descartes’ two causal principles are sometimes referred to as causal “adequacy” principles, since the claim is that the cause must be *adequate* for producing the effect in the sense of having equal or greater reality on Descartes’ tripartite scale of being. The first might be termed the “Formal Reality Principle” (FRP): everything that exists must have a cause with at least as much formal reality as itself. So, for example, according to this principle, a mind can (theoretically) cause another finite substance or a mode, but not God. A mode cannot cause anything except another mode, and as an infinitely real substance God can cause anything. Let us call the second principle the “Objective Reality Principle” (ORP): the objective reality of an idea must have a cause with at least as much formal reality as is contained in the idea objectively (AT VII 40–41, CSM II 28–29). The ORP is crucial to Descartes’ first causal argument because his strategy is to argue that because the idea of God has infinite objective reality, only a substance with infinite formal reality could be its cause. In fact, we now have the resources for stating Descartes’ first argument:

1. I have an idea of God that has an infinite degree of objective reality.
2. The Objective Reality Principle.
3. Therefore, the only adequate cause of my idea of God is a substance having infinite formal reality, that is, God himself.
4. Therefore, God exists.

This formulation of the argument has the virtue of remaining faithful to what Descartes actually says in the Third Meditation, while also reducing the argument to its essentials. But there is no *uncontroversial* formulation. Some commentators maintain that the argument has a more complex structure, especially those who see the ORP as being derived from other causal principles, such as the FRP (see, e.g., Curley 1978, ch. 6).

Descartes proclaims two advantages of his cosmological arguments over Scholastic versions, and we can see these reflected in the first premise. First, they deliver on the divine nature: they prove the existence not only of God but also of a certain kind of God, namely one who is actually infinite in every way and the creator of all things (see, e.g., AT VIIIA 13, CSM I 200). Second, they block the main

objection to the traditional cosmological argument, namely, that it encourages an infinite regress of causes. (If God causes the universe, then what causes God, etc.?) Descartes thinks he is able to achieve these results precisely because both of his cosmological arguments depend on the *idea* of God. The first advantage stems from the fact that, according to him, this idea represents a being who has all of the perfections that Christian theologians have traditionally assigned to him, including omnipotence, omniscience, immutability, eternality, and being the creator of all things (AT VII 40, 45; CSM II 28, 31). The nature of God is packed into this idea (though, curiously, benevolence is absent from his lists in the Third Meditation). The second advantage derives from the fact that this idea represents a first cause. Without this idea, Descartes holds, there would be no non-question-begging way to rule out an infinite series of finite causes (AT IV 112–13, CSMK 232).

a. Objections to Premise 1

Proceeding from a rich idea of God may be an advantage in one way, but in another way it leaves Descartes open to a potentially fatal objection, namely, that we do not in fact have such an idea. **Thomas Hobbes** and **Pierre Gassendi**, who authored the Third and Fifth Objections, respectively, insist on this point for different reasons. Hobbes denies that we have such an idea on the ground that all ideas are corporeal images, and there can be no image of something immaterial; the term “God” is just a label that we apply to the object of religious belief (AT VII 180, CSM II 127). By contrast, Gassendi grants that we have an idea of God, but not one of him as infinite, for the human **intellect** is incapable of conceiving of infinity. Descartes will insist on the innateness of the idea of God, but Gassendi goes on to offer an empiricist account of its origin that will be adopted by later empiricists such as **Locke** and Hume: we form the idea of God by taking attributes that we admire in ourselves – such as power, knowledge, and goodness – and amplifying or augmenting them in our thought. Gassendi argues, however, that the idea produced by this operation does not contain an infinite degree of objective reality and so does not require a cause with infinite formal being (AT VII 286–87, CSM II 200).

Descartes rejects Hobbes’s formulation of the objection as question begging: if you assume that ideas are corporeal images, then of course there can be no idea of God, but why make that assumption (AT VII 181, CSM II 127)? However, he acknowledges the force of the objection in its general form: “But if no such idea is to be found in me, I shall have no argument to convince me of the existence of anything apart from myself” (AT VII 42, CSM II 29). He also acknowledges the difficulties attendant upon discovering the idea of God *qua* infinite being within one’s mind: “Some people will perhaps not notice it even after reading the *Meditations*

a thousand times" (AT III 430, CSMK 194). His main strategy for answering the objection is to treat it as a plea for assistance. In the Third Meditation, he tries to induce or awaken the relevant idea in the mind of the meditator by means of the following consideration: the idea of God as an infinite being is conceptually *prior* to the meditator's idea of himself as finite. The meditator recognizes that he is lacking in certain respects (e.g., knowledge, power, goodness), but how could he understand that he was not wholly perfect "unless there were in me some idea of a more perfect being which enabled me to recognize my own defects by comparison?" (AT VII 45–46, CSM II 31). The point here is that if one has an idea of oneself as finite and imperfect, then one must also possess an idea of God as actually infinite and perfect to serve as a standard or exemplar.

It was a truism among medieval Christian philosophers that God is incomprehensible. Many such philosophers even maintained that God can be known only negatively, by denying of him various human attributes (the famous *via negativa*), or by **analogy** with human perfections. Descartes departs from this tradition by affirming that we can have a clear and distinct idea of God, but for theological reasons must hold that God is incomprehensible in some sense. Here he attempts to strike a delicate balance, and some commentators conclude that he fails in this endeavor. Descartes' main strategy is to draw a distinction between "understanding" and "grasping" God. Given my finite intellect, I cannot grasp *how* God is infinite or in what his infinitude consists; I understand only *that* he is so (AT VII 46, CSM II 32; AT VIIIA 12, CSM I 199). Descartes sometimes uses the analogy of a mountain: we can know that God is infinite "in the same way we can touch a mountain with our hands but we cannot put our arms around it. To grasp something is to embrace it in one's thought; to know something, it suffices to touch it with one's thought" (AT I 152, CSMK 25). Bernard Williams (1978, 129–30) finds this position untenable, arguing that Descartes must "both ... demand and ... deny determinate understanding of God's nature." For his argument to succeed, he needs it to be the case that we distinctly perceive God's attributes in their particularity, but in order to avoid violating the doctrine of divine incomprehensibility, he must deny that we have anything more than a hazy conception of them. It is not clear how Descartes would respond to this objection except to urge the reader to look for himself and determine whether his idea of God is indeed clear and distinct. In some places, Descartes insists that this idea is the most distinct idea of which we are capable. Precisely because it represents an infinite being, it "permeate[s] our thought to a greater extent, being simpler and unobscured by any limitations" (AT VIIIA 12, CSM I 199). Jean-Marie Beyssade (1992, 193) suggests that the tension is ultimately resolved by the analogy between the meditator and God; despite the vast gulf presented by God's infinity, one can understand his nature precisely because he, like the meditator, is a thinking thing.

b. Objections to Premise 2

There is plenty of room to object to the second premise since it seems to rest on several crucial assumptions, many of which are presented as “manifest to the natural light” and thus not in need of demonstration despite their counterintuitive character. First, one might object, as Hobbes does, to the very idea that reality is scaled (AT VII 185, CSM II 130). This assumption is especially foreign to our contemporary way of thinking, which treats existence as an on-or-off affair. But Descartes’ doctrine seems a bit more plausible once degrees of reality are analyzed in terms of relations of dependence: the claim that modes have less reality than finite substances, and that the latter in turn have less reality than God, might just mean that in each case the former depend on the latter (see Curley 1978, 130), though, as is often noted, the type of dependence differs in each case – finite substances causally depend on God, whereas modes are logically (or ontologically) dependent on created minds and bodies (see Kenny 1968, 134).

Second, even if one grants that ideas have objective reality, one might object to the assertion that the objective reality of an idea requires a cause (let alone a cause with a sufficient degree of formal reality). **Caterus**, who authored the First Objections, argues this point on the ground that objective being is not a real entity but merely an “**extrinsic denomination**,” which refers to an act of the mind that can occur even when there is no external object (e.g., when thinking of a fictional entity such as a unicorn) (AT VII 92, CSM II 67). If ideas or their objective beings are not real entities, then they do not require causes. However, Caterus’s objection rests on a tendentious conception of objective reality that Descartes clearly does not share (which is not to say that he has an argument for it). Descartes’ own conception is difficult to interpret and the subject of considerable controversy (see, e.g., Chappell 1986, Nelson 1997, Normore 1986), but one thing is clear: for him, objective being is a real form of being – however attenuated or slight – and thus requires a cause (AT VII 102–3, CSM II 75) (see **being, formal versus objective**).

A third line of objection focuses on how Descartes purports to establish the ORP. Following Hume, some commentators have urged that Descartes’ efforts to demonstrate this principle are circular. The ORP, they contend, is derived from other principles, including the principle that everything has a cause. The problem is that in order to establish the latter, Descartes presupposes it (see Williams 1978, 141, and Dicker 1993, 116–117). One interpretive solution would be to say that the ORP is not the product of demonstration but is self-evident, and in fact Descartes sometimes presents it in just this way (see AT VIIIA 12, CSM II 199). Critics might complain that nothing could be *less* self-evident, but John Cottingham has argued that the ORP is actually on firmer ground than FRP and appeals to Descartes’ analogy

between the idea of God and the idea of an intricate machine to persuade us of this (see AT VII 103–4, CSM II 75–76; Cottingham 1985, 52–53).

Even if the ORP is a derived truth, as long as it derives from other principles that are in fact primitive, including the principle that everything has a cause, then the circularity problem disappears. This does not entail, however, that Descartes is on completely safe ground, for Hume famously raises doubts about whether there is any rational justification for the claim that everything has a cause. He notes that one can always *imagine* something coming into existence without a cause and concludes from this that it is possible for something to so exist (*A Treatise of Human Nature* I.iii.3). But, as a rationalist, Descartes would not be impressed by appeals to the imagination and takes it as one of the dictates of reason that everything has a cause. In the Geometrical Exposition, he lists it as the very first axiom: “Concerning every existing thing it is possible to ask what is the cause of its existence” (AT VII 164–65, CSM II 116). Moreover, he holds that to conceive (rather than to imagine) any finite being clearly and distinctly is to regard it as (causally) *dependent* on something else for its existence (AT VII 166, CSM II 117). Given these considerations, perhaps the focus on the debate between Descartes and Hume on this issue should be about what we are capable of conceiving and what this shows about what is or is not possible.

It is sometimes argued that in addition to FRP and ORP, Descartes commits himself to a strong causal likeness principle, according to which *any* property contained in the effect must also be contained in the cause (see Radner 1985, Cottingham, 1986, 50–51; for an opposing view, see Schmaltz 2008, 28). Such principles, which harken back to Scholasticism, seem implausible. But it is unlikely that Descartes is actually committed to anything like this, given his endorsement of “eminent” containment, according to which the cause can contain what is in the effect in a “higher,” nonliteral sense (see **containment, eminent versus formal**). For example, he holds that he could be the eminent cause of his ideas of corporeal things such as extension, shape, and motion, even though he is nothing but a finite thinking thing that bears no resemblance to extended substance (AT VII 45, CSM II 31). Moreover, Descartes does not need a strong causal likeness principle for the purposes of the cosmological argument. It suffices that the cause has at least as much *being* or *reality* as the effect; causal likeness is confined to degree of being.

Perhaps the most important objection to the first cosmological argument concerns the truth of the ORP itself. Descartes stresses that objective reality is a less perfect kind of being than formal reality. But if that is right, then why suppose that something with objective reality must have a cause with at least as much formal reality? Given the more perfect nature of formal reality, it would seem that anything possessing it could be the cause of the objective reality of the idea of God, including the meditator himself (Wilson 1978, 137–38).

2. THE SECOND COSMOLOGICAL ARGUMENT

Descartes seems to have had several reasons for introducing a second cosmological argument in the Third Meditation. For one, he realized that since the idea of God can be found within the meditator's mind, it is natural for her to suppose that she caused it or that "it belongs to the nature of our own intellect" and thus needs no cause (AT VII 47, CSM II 32; AT VII 105, CSM II 76). The strategy of Descartes' second argument is to show that, even if that supposition were true, the intellect or mind that has this idea would still require God as its cause. But his purpose is "not to produce a different proof ... but rather to take the same proof and provide a more thorough explanation of it" (AT VII 106, CSM II 77). The second proof is, in fact, different from the first in its details, but both arguments depend on the idea of God. One commentator proposes that the meditator *qua* self-conscious thinker *just is* her idea of God (Baier 1986, 365–66). If true, this would provide another sense in which the two arguments are similar: they both proceed from the same effect but seek the cause of this effect in different ways. It is much easier to appreciate that one cannot be the cause of oneself than it is to see that one cannot be the cause of one's idea of God. But on Baier's proposal, if the former is implausible, then so is the latter. Thus, the second argument complements the first.

In the Third Meditation, Descartes presents the second cosmological proof as an argument from elimination.

1. Everything that exists has a cause for its existence.
2. There are three mutually exclusive and jointly exhaustive possibilities concerning the cause of my existence as a thinking thing:
 - (i) I am self-caused,
 - (ii) I was caused by some other finite being, or
 - (iii) I was caused by God (i.e., an actually infinite being).
3. If I were self-caused, then I would have given myself all of the perfections that I perceive in my idea of God (i.e., I would be God).
4. I am imperfect (i.e., I am not God).
5. Therefore, not (i).
6. By parity of reasoning in premises 3–5, no finite being could be my cause.
7. Therefore, not (ii).
8. Therefore, God exists as my cause and has all of the perfections contained in my idea of him. (AT VII 48, CSM II 33)

One of the main virtues of the second cosmological argument is that it does not depend on Scholastic causal principles. It relies instead on the general causal principle, previously discussed, which is more plausible. Descartes likely realized that even some of his contemporary readers would be put off by the Scholastic principles.

As for the second premise, if one assumes as Descartes does that there can be only one actually infinite being, then the three possibilities he enumerates are indeed exhaustive. The linchpin of the argument is the third premise, which is Platonic in character. The idea is that one is irresistibly drawn to the highest good or perfection. In the Third Meditation, Descartes claims that it would require greater power to cause one's existence than it would to give oneself particular perfections such as omniscience or omnipotence. So if one had the power to cause one's existence, then *a fortiori* one would have the power to give oneself all perfections. (An alternative to premise 3 would be: "If I had the power to cause myself *ex nihilo*, then I would be omnipotent." Premise 4 would then state: "I am not omnipotent.") Descartes derives the fourth premise from one's self-awareness as a thinking thing. From the fact that one doubts, for example, one knows that one lacks perfect wisdom. The principles enunciated in premises 1–4 may not be "manifest to the natural light," but they are certainly more plausible than ORP and FRP.

Another reason Descartes presents a second argument is that it enables him to address the main objection to the traditional cosmological argument: if everything has a cause, then what about God? Doesn't the universal character of the causal principle invite an infinite regress? Some Scholastic philosophers found the notion of such a regress to be inconceivable and thus posited God as the "First Cause," that is, the being that causes everything else but is not itself caused (the uncaused cause or, in Aristotle's memorable phrase, the unmoved mover). Notoriously, such a response begs the question: if one is going to break the regress arbitrarily, why not suppose that the universe is the First Cause? For his part, Descartes agrees that a regress is "beyond my grasp," but he does not think it follows from the finitude of our intellect that a regress is impossible (AT VII 106, CSM II 77). Indeed, there are many things that are beyond our grasp that actually occur: for example, matter is divided indefinitely, and the universe is indefinitely extended. So, for Descartes, the regress objection is fatal to the traditional version of the cosmological argument.

He thinks he can effectively stop the regress himself by claiming that God is self-caused (*causa sui*). But this claim shocked his contemporaries, especially Caterus and Arnauld in the First and Fourth Objections to the *Meditations*. Aquinas had famously argued that the notion of self-causation is incoherent (*Summa Theologica* Ia, 2.3). When one says that "x causes y" part of what one means ordinarily is that (a) x is distinct from y and (b) x is temporarily prior to y. But a thing cannot be distinct from, or prior to, itself. Caterus and Arnauld proposed a simple solution. The claim that God is *causa sui* should be understood negatively: he has *no* cause (AT VII 95, 208; CSM II 68, 146). But Descartes cannot accept this solution as it would violate the universal character of the causal principle. God must be *causa sui* in some positive sense. So instead he argues that God is his own *formal* (rather than efficient) cause, where the term "formal" refers to the divine essence or nature. In virtue of

the immensity of his power, God needs no external cause. His essence is the “cause or reason” for his existence (AT VII 236–36, CSM II 165), which is another way of saying his essence just is his existence. This solution succeeds, however, only if one takes the general causal principle, stated in premise 1 to be a version of the principle of sufficient reason: everything has a cause *or reason* for its existence (Nolan 2014, 144). There is strong textual evidence that he does understand it in that way (see AT VII 164–65, CSM II 116).

See also Being, Formal versus Objective; Cause; Containment, Eminent versus Formal; Existence; Falsity, Material; God; Idea; Infinite versus Indefinite; Ontological Argument; Scholasticism

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LAWRENCE NOLAN

COSMOLOGY

Descartes was putting the finishing touches on *The World* when, in the fall of 1633, he heard about the condemnation of **Galileo**. As a consequence, he decided not to publish his treatise, as the hypothesis of the earth's motion could not be removed from it "without rendering the whole work defective" (AT I 271, CSMK 41) (see **earth, motion of the**). Although *The World* appeared only posthumously, Descartes did reveal his cosmological views in his *Principles of Philosophy* (1644). In the third part of that work, which deals with the "visible universe," he argued that Copernicus's theory not only explains phenomena much better than Ptolemy's but is also "a little simpler and clearer" than Tycho's (AT VIIIA 85, CSM I 250). Descartes adopted two strategies to protect himself against the risk of legal attack by either the Catholic or the Protestant church. The first consists in maintaining that strictly speaking the earth does not move (AT VIIIA 90, CSM I 252). Planets are in fact carried around by a **vortex of subtle matter** circling the sun, which means that they remain at rest in the surrounding medium (Garber 1992, 181–88). Second, Descartes resorted to "the standard subterfuge for astronomers and natural philosophers seeking to avoid trouble," namely that of presenting his cosmological theory as a mere hypothesis (Finocchiaro 2005, 50–51). In spite of these prudential measures, Descartes was, however, regarded by contemporary readers as a "realist Copernican." As shown by Schuster, the *Principles* offer a descriptive-explanatory narrative unifying his theories of vortices, **magnetism**, sunspots, stellar novae, and newly discovered variable stars, along with a theory of planet formation from dead, sunspot-encrusted stars. This tour de force amounts to the most daring and radical statement of a multistellar Copernican system to that date (Schuster 2013, 543–86).

Both in *The World* and in the *Principles*, Descartes puts forward a fictional account of the genesis of the universe, which he integrates with graphical representations of the solar system and with analogical **explanations** of the behavior of planets, stars, and comets. Chapter 6 of *The World* narrates how **God** initially divided matter into parts of different size and **shape** and caused them to move "in accordance with the ordinary **laws of nature**." These laws have been established in "such a marvelous way" that they are "sufficient to cause the parts ... to arrange themselves in such a good order that they will have the form of a most perfect world, a world in which one will be able to see not only **light**, but all the other things ... that appear in the actual world" (AT X 34, G 23). A similar account is found in the *Principles* (AT VIIIA 101–4, CSM I 257–58), where Descartes supposes, however, that God set in **motion** equal parts of matter, which later differentiated themselves into the three **elements** of which the universe is made.

Through his "fable of the world," Descartes describes the formation of a cosmos consisting of innumerable stars and planetary systems.

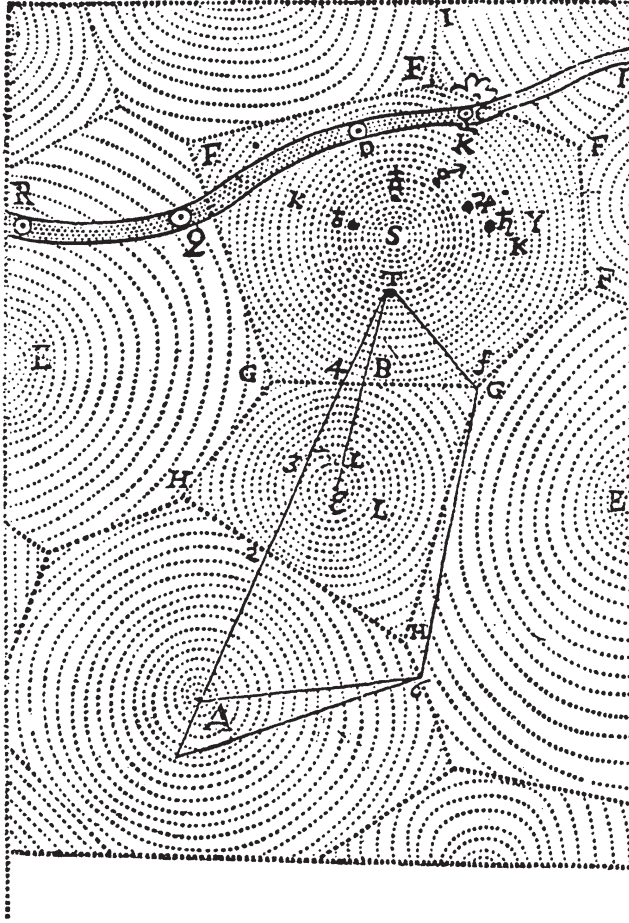


Figure 4. Celestial vortices (*The World*, 1677).

Figure 4 represents a number of contiguous vortices. In one of them, at point S, we find the sun, which like all stars is made of the most subtle particles existing in nature, those of the first element. The **vortex** rotating around the sun (S) is composed of particles of the second element, which vary in size: the smallest and fastest occupy the lower region (around S), whereas the biggest and slowest occupy the upper region (as far as K). Above the point K the speed of the particles increases again. Descartes believes that the particles of the vortex are ordered according to their sizes, as large bodies are more effective than small ones at realizing their centrifugal tendency. (See **vortex** for details on Descartes' distribution of the size of the particles with distances from the central star.) This also applies to the planets, which are in a state of orbital equilibrium, because they possess the same "force to continue their motion in a straight line" as the particles of the circulating matter

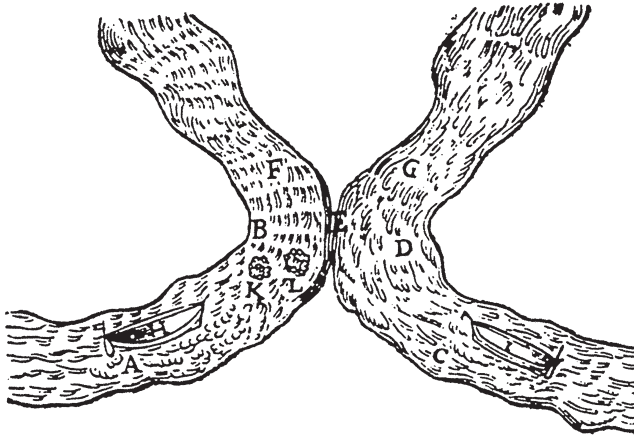


Figure 5. Comets and the two-rivers analogy (*The World*, 1677).

by which they are being carried. A planet's orbital distance results from the balance between its centrifugal tendency, which is proportional to a body's volume or surface ratio or its massiveness, and its **gravity**, which is a function of how a body's massiveness resists the centrifugal tendencies of the nearby portions of the second element making up the vortex. This is why "the greater a planet's ... massiveness, the more distant that planet's orbit will be from the central star" (Schuster 2013, 467). The channel passing through the points K, D, Q, R represents the trajectory of a comet, which, though made of the same element as the planets, has a greater massiveness and, hence, does not orbit but rather travels from one vortex to the next, never penetrating within a vortex below distance K from its center.

As was customary among adherents to the fluid skies theory, Descartes explained planetary motion by **analogy** with the behavior of objects floating on water (Palmerino 2007). Planets are compared, in *The World*, with boats carried by a river's current and, in the *Principles*, with objects caught in a whirlpool.

In chapter 10 of *The World*, Descartes resorts to the river analogy in order to explain why planets have different orbital speeds: just as "boats following the course of a river never move as fast as the water that bears them, nor indeed do the larger among them move as fast as the smaller, so too, even though the planets follow the course of celestial matter," they do not "move exactly as quickly as it," nor do the most massive move as fast as the least massive (AT X 68, G 44). In chapter 9, Descartes invokes the example of two bending rivers touching at a given point (Figure 5) in order to explain how planets, with stable orbital distances, differ from comets, which wander among vortices.

Descartes notices that "the boats and other massive and heavy bodies that are carried by the course of the one river will be able to pass easily into the other

river ... whereas the lightest bodies will swerve away from it and will be thrown back by the force of the water towards wherever it is the least rapid" (AT X 58–60, G 38–39). The boat and other massive bodies are analogues of comets; the flotsam kept within the first river are analogues of planets. The bending rivers model is, however, at odds with Descartes' cosmogonical fable, according to which the smallest planets found their place in those layers of the whirling subtle matter that were the most, not the least, rapid. This might explain why, in the *Principles*, Descartes substitutes the planet-boat analogy with a new one. He now compares the universe to a river in which whirlpools are formed at various places and the planets to bits of straw caught in the whirlpool (AT VIIIA 81–82, CSM I 249). The vortex-whirlpool analogy enables Descartes not only to account for the different orbital speeds but also to explain why planets rotate around their own axis, why their paths are not perfectly circular, and why they can have satellites. Moreover, the multiple whirlpools model seems to be a good analogue for a cosmological theory in which a star of the first element must inhabit the center of each vortex and in which multiple vortices are necessary not only to contain the respective centrifugal tendencies of the particles of the second element but also to receive the equatorial outflows of first matter that ultimately form sunspots on other stars (Schuster 2013, 461–64, 553–58).

This is not to say that Descartes' theory of planetary motion was free from internal problems. According to Eric Aiton (1972, 44), Descartes made use of the whirlpool analogy in order to "avoid a chain of difficult deductions – in this case the derivation of the precise nature of vortex motion from the rules of collision." As a matter of fact, the deduction was not merely difficult; it was outright impossible. The rules of collision formulated in the second part of the *Principles* are valid only in a counterfactual void space and do not apply to oblique collision. Moreover, in order to determine a planet's gravity, one should have to determine the number of particles of the third element contained in it, which is of course unfeasible. Yet Descartes' vortex theory, which was convincingly criticized by **Newton** for being irreconcilable with **Kepler's** laws and incompatible with the observed behavior of planets and comets, enjoyed great popularity until the mid-eighteenth century, especially among those natural philosophers who were not willing to endorse Newton's view of gravity as a **force** acting at a distance.

See also Analogy; Earth, Motion of the; Element; Gravity; Law of Nature; Motion; Subtle Matter; Vortex

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CARLA RITA PALMERINO

CUDWORTH, RALPH (1617–1688)

Cudworth was the most significant philosopher among the Cambridge Platonists. Only a fraction of his manuscript writings on ethics and epistemology was published, and that posthumously: his *Treatise concerning Eternal and Immutable Morality* (1731) and his *Treatise of Freewill* (1838). The major work published in his lifetime was his *The True Intellectual System of the Universe* (1678), an antideterminist analysis of philosophical atheism in all its manifestations, both ancient and modern. The humanist learning in which this book is steeped masks the modernity of his philosophical outlook and especially, perhaps, his admiration for Descartes. For although Cudworth had major criticisms of **Cartesianism**, Descartes informs his **philosophy** in fundamental respects. He lauded Descartes as the reviver of ancient atomism. He regarded the Cartesian conception of **body** as inert **extension** as the most intelligible account of corporeality, and the premise of a theory of immaterial (i.e., spiritual) causation. He shared Descartes' view of **mind** as a distinct **substance** from body. And he took clear and distinct **perception** as the principle of epistemological **certainty**. However, Cudworth was also critical of Descartes. As concerns **dualism**, the operative distinction for Cudworth is not between mind and body, but between **force** and matter, active and passive. Incorporeality is not coterminous with the mental – all self-moving substance is incorporeal; and there are mental activities that neither are conscious nor involve cogitation – in other words, "unconscious." For Cudworth, the boundaries of the incorporeal and corporeal are softened by his conception of "plastic natures" that govern life processes and direct the workings of nature toward providential ends. He was critical of Descartes' theory of **animal** mechanism and rejected his proof of the **existence** of **God** based on the truth of our **faculties** as circular (see **Circle**, **Cartesian**). And he criticized Descartes' rejection of final **causes**. The fundamental error of Cartesianism was its misidentification of God's will as arbitrary indifference, not subject to divine wisdom. Such a conception of

the deity destroys both moral and epistemological certainty, opening the way to irreligion, skepticism, atheism. In his *Treatise concerning Eternal and Immutable Morality*, he develops the ethical dimension of the argument and lays the basis for a theory of active mind. His theory of mind is developed to an elaborate degree in his *A Treatise of Freewill* and in his unpublished manuscript writings "On Liberty and Necessity."

See also Animal; Atom; Cartesianism; Cause; Circle, Cartesian; Dualism; Substance

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SARAH HUTTON

DANIEL, GABRIEL (1649–1728)

A **Jesuit**, Daniel was born in Rouen and died in Paris. He was primarily a historian, publishing a *Histoire de France*, in three volumes in 1713 with subsequent expanded editions. It is a work that was praised by such later notables as Augustin Thierry and Sainte-Beuve. He was appointed historiographer of France by Louis XIV.

Daniel was also a polemicist, indefatigably defending the Jesuits, most notably, but not exclusively, against the blisteringly ironical attacks of **Pascal** in the *Provincial Letters*. Daniel's *Entretiens* ranges over issues from Pascal's style to such hard topics such as philosophic sin and probabilism. In the seventh dialogue, for example, he addresses Pascal's allegation that the Jesuits teach an indefensibly lax theory of morality, in this instance that love of Christ the Redeemer is not necessary for salvation. The specific issue is whether imperfect contrition (sorrow for sin because of impending punishment) is sufficient for the sacrament of penance, or forgiveness, or whether perfect contrition (sorrow for sin simply as an offense against God) is required. Daniel points out that the Jesuits agree with Pascal and the Jansenists that perfect contrition is very hard but draw the conclusion not that many are damned but that the new law, based on Christ's sacrifice, requires only imperfect contrition (see **Jansenism**). The upshot is that the tables are turned, and Pascal stands accused of minimizing the significance of Christ's Redemption. Pascal had died in 1667, but the debate continued with Mathieu Petitdidier's reply to Daniel.

Daniel's penchant for fictionalized polemic had already been demonstrated in a kind of ironic history that he wrote, the satirical send-up of Descartes' theory of vortices in the *Voyage du monde de Monsieur Descartes* (1690), followed by an expanded edition, and by a *Suite* (see **vortex**).

See also Jansenism; Pascal, Blaise

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THOMAS M. LENNON

DEBEAUNE (DE BEAUNE), FLORIMOND (1601–1652)

Debeaune was born in Blois to Florimond de Beaune senior, Seigneur de Goulioux. He was educated in Paris, where he studied law, before entering military service. His second marriage to Marguerite du Lot in 1623, following the death of his first wife, brought him considerable wealth. On the basis of his legal studies, he bought himself the office of *conseiller* to the court of justice in Blois. An amateur mathematician and landowner, he built up an extensive library and constructed an observatory on his estate near Blois. Through both the medium of correspondence and regular visits to Paris, he participated actively in contemporary scientific discourse. He exchanged letters with men such as **Mydorge**, Billy, and **Mersenne**, while Descartes and Erasmus Bartholin visited him in Blois to discuss mathematical topics.

Little of his mathematical work survives, apart from what is published in the Schooten's Latin translation of the *Geometry*. Descartes believed that no one understood his work better than his wealthy friend. Debeaune's *Notes brèves*, translated by Schooten in 1649, served to clarify numerous difficult passages and played an important part in the reception of the work. Shortly before Debeaune died, he met with Bartholin, leading to the publication of two short papers on algebra in Schooten's second edition. Of Debeaune's other work, a treatise of **mechanics** is mentioned by Mersenne, and a treatise on dioptrics is mentioned by Schooten; neither has survived.

Debeaune's legacy consists primarily in his work on two problems. He was the first to point out that the properties of a curve can be deduced from the properties of its tangent, and he achieved important results on the determination of the tangent to an analytically defined curve. Furthermore, he considered for the first time the upper and lower limits of the roots of numerical equations.

He had the reputation of being the finest instrument maker of his day. In 1639 Descartes asked Debeaune to build the machine for grinding hyperbolic lenses, which he had described in *Dioptrics* (AT II 511–12). Having embarked on this project, at the beginning of 1640, Debeaune cut his hand badly on glass. Poor health set in. Around 1648 he retired his post of *conseiller*. He died following the amputation of a foot.

See also Dioptrics; Geometry; Mathematics; Mersenne, Marin

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PHILIP BEELEY

DEDUCTION

In his early *Rules for the Direction of the Mind*, Descartes recognizes only two sources of **knowledge**: intuition and deduction (AT X 368, CSM I 14; cf. AT X 372, 400, 425; CSM I 16, 33, 48). *Intuitus* is not “the fluctuating testimony of the senses” (empirical intuition or sense **perception**) but “the conception of a clear and attentive **mind**, which is so easy and distinct that there can be no room for **doubt**.... Alternatively, intuition is the indubitable conception of a clear and attentive mind which proceeds solely from the light of **reason** (*rationis lux*)” (AT X 368, CSM I 14) (for “intuition,” see **clarity and distinctness**). Since the examples Descartes gives here include not just the contingent **truths** *cogito* and *sum* (“everyone can mentally intuit that he exists, that he is thinking”), but also necessary truths regarding the “**simple natures**” of both “spiritual” or “intellectual” and “corporeal” or “material” things (AT X 399, CSM I 32; cf. AT X 419, CSM I 44), intuition cannot be confined to immediate *logical* insights, be they intrapositional, like “a triangle is bounded by just three lines” (AT X 368, CSM I 14), or interpropositional, like “all A is B, all B is C, therefore all A is C” (AT X 439, CSM I 57). The former (the immediate apprehension of a logical relation between concepts, or between the properties they denote) are, however, part of what Descartes means by intuition. As for logical relations of an interpropositional nature, they may be intuitions or deductions, depending on how long a chain of inferences is involved.

Deductio is defined as “the inference of something as following necessarily from some other propositions which are known with **certainty**” (AT X 369, CSM I 15).

Although it differs from “pure intuition” in being mediate, the boundary between the two is quite fluid:

We are distinguishing mental intuition from a certain deduction on the grounds that we are aware of a movement or a sort of sequence in the latter but not in the former, and also because immediate self-evidence is not required for deduction, as it is for intuition; deduction in a sense gets its certainty from **memory**. It follows that those propositions which are immediately inferred from first principles can be said to be known in one respect through intuition, and in another respect through deduction. But the first principles themselves are known only through intuition, and the remote conclusions only through deduction. (AT X 370, CSM I 15)

As Descartes notes, “the two operations aid and complement each other ... so thoroughly that they seem to coalesce into a single operation” (AT X 408, CSM I 38) at times:

If we have deduced one fact from another immediately, then provided the inference is evident, it already comes under the heading of true intuition. If on the other hand we infer a proposition from many disconnected propositions, our intellectual capacity is often insufficient to enable us to encompass all of them in a single intuition.... In the same way, our eyes cannot distinguish at one glance all the links in a very long chain; but, if we have seen the connections between each link and its neighbour, this enables us to say that we have seen how the last link is connected with the first. (AT X 389, CSM I 26)

Although deduction can at times, and should as far as possible, be reduced to intuition by going over its constituent stages repeatedly with increasing rapidity, where the role of memory is ineliminable, deduction is called **enumeration** or **induction** (cf. AT X 408, CSM I 37).

The wording of the cited passages no doubt suggests *logical* inferences of the sort found in long chains of mathematical and philosophical reasoning. Yet, it appears that “deduction,” if one attends to Descartes’ scientific practice as well as his methodological reflections, “covers a wide range of inferential procedures, such as induction [over members of a class], arguments by analogy, hypothetico-deductive explanations, retro-deductive inferences, or any argument the structure and evidentiary value of which is clear” (Clarke 1993, 115; cf. 112, where “arguments from models” are added, and Clarke 1982, §8 and appendix 1). Practically the only thing *not* covered are “those chains with which dialecticians suppose they regulate human reason,” namely “probable **syllogisms**” (AT X 363–65, CSM I 11–12; on “dialectic”

or school logic, cf. AT X 372, 389, 405–6, 439–40, CSM I 16, 26, 36–37, 57; AT VI 17, CSM I 119; and AT V 175, CSMK 350).

The foregoing is the object of a broad scholarly consensus. The controversial matter to be mooted in the remainder of this entry is whether the **method** of analysis employed in the *Meditations* features among the meanings of *deductio* in the unfinished treatise of 1628 (see **analysis versus synthesis**). No such problem arises concerning the method of synthesis adopted in **Geometrical Exposition** appended to the Second Replies (cf. AT VII 160–70, CSM II 113–20) and employed again – albeit in hybrid form – in the *Principles* (see, however, Garber and Cohen 1993, and the rejoinder of Curley 1993); for although the term “deduction” occurs less frequently after 1628 (cf. Clarke 1982, 75 n. 28), the logical derivation of specific conclusions or theorems from intuitively evident general **definitions**, axioms, and postulates is *one* sense of “deduction” that was never far from Descartes’ mind. Still, it may not be the sense most relevant to that universal method whose extension from arithmetic and **geometry** to the “somewhat more advanced” (AT X 379, CSM I 20) sciences of nature (cf. AT X 377, 393–95, and 402–3, CSM I 19, 28–29, 34) and to **metaphysics** itself (cf. AT X 390, 411, 421–22, CSM I 26, 40, 46) is the programmatic aim of the *Rules* (AT X 366, 374, 442, CSM I 12–13, 17, 59), especially if *mathesis universalis* (AT X 378, CSM I 19) signifies not the synthetic “order ... of exposition” (AT V 153, CSMK 338) epitomized by Euclid’s *Elements* but the analytic “order of discovery” described this way in the Second Replies:

When someone says “I am thinking, therefore I am, or I exist,” he does not deduce **existence** from thought by means of a syllogism, but recognizes it as something self-evident by a simple intuition of the mind. This is clear from the fact that if he were deducing it by means of a syllogism, he would have to have had previous knowledge of the major premise “Everything which thinks is, or exists”; yet in fact he learns it from experiencing in his own case that it is impossible that he should think without existing. It is in the nature of our mind to form general propositions out of knowledge of particulars. (AT VII 140–41, CSM II 100)

This advance from a particular (or restrictedly general) contingent to an unrestrictedly universal, necessary, or **eternal truth** is obviously “not an ordinary induction. The move from the particular to the general would be more like what is sometimes referred to in discussions of Aristotle as intuitive induction, i.e. a process not of reasoning but of direct insight into first principles, mediated ... by a review of particular instances” (Curley 1993, n. 10). The contrast drawn in the preceding passage is not, however, with “ordinary” empirical or generalizing induction, but with deductive, logical, or syllogistic reasoning. This includes not just the patterns of valid reasoning codified by Aristotle but any deductively valid proof of the sort that proceeds from

the universal to the particular employing more than a single premise. Yet that need not mean (*pace* Curley) that no discursive reasoning, no deduction of *any* kind, is involved. For the process is said to be “mediated,” whereas “pure intuition of a single solitary thing” (AT X 440, CSM I 57) is by definition “simple” (AT X 389, CSM I 26) and immediate or “self-evident” (AT X 420, CSM I 45).

Could the preceding passage be a description of that “movement of thought” (AT X 387, 407; CSM I 25, 37) which distinguishes *deductio* from *intuitus* in the *Rules*? If so, then the uses of *deductio*, *dédution*, *deducere*, *déduire* (and cognate terms meaning “infer,” “demonstrate,” and “prove”) listed here should be supplemented by that analytic *modus demonstrandi* by which Descartes established the first principle of his metaphysics, deriving therefrom the universal axiom “Whatever thinks, exists.” This *nonlogical* derivation may even be the sense of *deductio* most pertinent to the *mathesis universalis* of the *Rules*. True, the peculiar movement of thought from *cogito ergo sum* to the axiom “Everything that thinks, exists” is nowhere expressly evoked in the *Rules*. And yet, at one point, the axiom or **common notion** “Things that are the same as a third thing are the same as each other” is said to be known “either by the pure **intellect** or the intellect as it intuits the images of material things” (AT X 419–20, CSM I 45). So *non*-logical inferences from concrete particular instances to the universal axioms they instantiate are at least mooted in the *Rules*. If this is correct, then what was said of *intuitus* holds for *deductio* too: any restriction to purely logical inferences (even in the broad sense of the “logic of scientific discovery”) results in serious foreshortening.

See also Analysis versus Synthesis, Certainty, Clarity and Distinctness, Common Notion, Definition, Enumeration, Eternal Truth, Geometrical Exposition, *Mathesis Universalis*, Reason

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DEFINITION

One basic enterprise in **philosophy** going back to the ancient Greeks is to answer the question, What is it? It is reasonable to construe the answers to such questions as definitions, or what are nowadays called “*real* definitions,” since they typically go beyond the mere meanings of words and aim to specify the **essences** of things. Who, having read Plato’s dialogues, can forget Socrates’ quest for definitions of things like “**knowledge**,” “justice,” or “virtue”? Aristotle and his Scholastic heirs continued and further developed this tradition. Aristotle distinguished different types of definitions, but definitions in the primary sense represent the essences of species. One defines an essence in terms of a genus and a differentia, as in the case of the species man, defined as rational animal. Since, on Aristotle’s view, essences constitute the first principles of the sciences, definitions play a key role in his epistemology and in syllogistic reasoning, which is intended in part to systematize our knowledge of the natural world (see **syllogism**).

Descartes is very suspicious of this entire tradition, expressing three related criticisms of philosophical definitions: they obscure concepts that are already clear and distinct, tend to be vacuous, and fail to advance our knowledge. Concerning the first, he writes in the *Principles* I.10: “I have often noticed that philosophers make the mistake of employing logical definitions in an attempt to explain what was already very simple and self-evident; the result is that they only make matters more obscure” (AT VIIIA 8, CSM I 296; cf. AT III 597, CSMK 139). It helps to remember that for Descartes our simple ideas are innate. These include the ideas of **thought**, **existence**, and **certainty**, which one must grasp first in order to appreciate the force of the *cogito*. Elsewhere he notes that in order to understand these and other such concepts, we do not “have to rack our brains trying to find the ‘proximate genus’ and ‘essential differentia’ which go to make their true definition. We can leave that to someone who wants ... to debate in the Schools.” All one must do is look within one’s own **mind**. It is a mistake to “try to define what should only be conceived” (AT X 523–24, CSM II 417).

Descartes states his second criticism by mocking what he takes to be Aristotle’s definition of **motion**: “A man who walks across a room shows much better what motion is than a man who says ‘It is the actuality of a potential being in so far as it is potential’” (AT III 597, CSMK 139). Definitions tend to be devoid of content, a jumble of words used without meaning. His third criticism is in part a consequence of the other two. If definitions obscure concepts that are otherwise distinct, and tend to be vacuous, then they are unlikely to provide a method of discovery.

Despite these criticisms, Descartes offers definitions of several key notions, such as **thought**, **substance**, **mind**, **body**, and **God**, in the **Geometrical Exposition**, appended to the Second Replies. He provides these definitions to satisfy his objectors, who had asked him to recapitulate the argument of the *Meditations* in Euclidean

fashion, starting from definitions and axioms, and then deriving theorems. The definitions that he provides are, like Aristotle's, not merely of the meanings of words, but many of the terms that he defines – such as “**idea**,” “objective reality,” and “really distinct” – are terms of art within Cartesian **philosophy**. They are not species terms or sortals, or general terms like “virtue” or “goodness,” the traditional subjects of definition in philosophy. The definitions that Descartes provides also reflect views that he articulates elsewhere without the pretense of giving definitions. Many readers welcome these definitions of key terms, as they cannot be found in the *Meditations* proper and serve as a glossary to Cartesian philosophy. But the absence of such definitions in that work reflects Descartes' view that the “primary notions” in **metaphysics** are discovered last. Unlike **geometry**, where the axioms and definitions are immediately self-evident, in metaphysics one must “reason up” to first principles, which are often obscured to us by our reliance on the senses and the philosophical **prejudices** they engender (AT VII 156–57, CSM II 111). Although he does not use the term “definition,” Descartes provides something close to that for terms like “**clarity and distinctness**” in the *Principles* (see AT VIIIA 21–22, CSM I 207–8). This use of quasi definitions is often attributed to the synthetic mode of presentation, as opposed to the analytic mode that Descartes purports to employ in the *Meditations* and that he regards as best suited to metaphysical subjects (see **analysis versus synthesis**).

Aristotle and the Scholastics are not the only targets of Descartes' critique of definitions. He distinguishes his version of the **ontological argument** from that of Anselm and takes the latter to be inferior precisely because it depends on a definition of the word “God.” “Yet, because a word conveys something, that thing is not therefore shown to be true.” Descartes bases his version of the argument instead on an innate idea or **true and immutable nature** of God (AT VII 115, CSM II 83). But there is some controversy here: some commentators argue that what Descartes is objecting to is that Anselm offers only a *nominal* definition of God rather than a *real* definition, as Descartes' own version purports to provide (see **ontological argument**).

See also Analysis versus Synthesis, Deduction, Essence, Geometrical Exposition, Idea, Knowledge, Syllogism

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DESARGUES, GIRARD (1591–1661)

Desargues was born in Lyon. His father was a royal notary, and the family was clearly wealthy, with various properties in and around Lyon. Little is known about Desargues' early life and education. By 1626 he was in Paris and moving in mathematical circles. Later, he is recorded as having regularly attended **Mersenne's** meetings with men such as Étienne Pascal, **Mydorge**, and Hardy, and probably much of his early mathematical work was produced for distribution among such contemporaries.

In 1636 he published *Une methode aisée pour apprendre et enseigner à lire et écrire la musique*, which was later included in Mersenne's *Harmonie universelle*. The same year also saw publication of *Méthode universelle de metre en perspective les objets donnés réellement*, in which Desargues formulated the mathematical rules of perspective that had been developed by painters and architects during the Renaissance. Desargues' most important work, in which he set out the foundations of projective **geometry**, is the *Brouillon project d'une atteinte aux événemens des rencontres du cone avec un plan*. This "Rough Draft" is short and somewhat impenetrable; beginning with topics such as the range of points on a line, Desargues proceeds to show that conics can be discussed by means of properties that are invariant under projection. Remarkable thereby is the rigorous treatment of cases involving infinite distances. Not many copies were printed, and few apart from **Blaise Pascal** recognized its significance. For Descartes, Desargues' failure to employ algebra limited the scope of his approach.

Descartes corresponded with Desargues indirectly through Mersenne and praised his articulation of the principles of gnomonics or dialing. For his part, Desargues, in 1638, joined forces with Mydorge and Hardy in defending Descartes against attacks from **Roberval** and Étienne Pascal during their dispute with him over **Fermat's** method of determining maxima and minima.

In 1640 Desargues published under the Brouillon project an essay on stone cutting and on gnomonics, showing how his graphical method was to be used as a means to simplifying the construction of sundials. This was an area of mathematical practice traditionally governed by the laws of trade guilds and is indicative of his concern for applications of **mathematics**.

A dispute over the publication, in 1642, of Dubreuil's *La perspective pratique*, in which Desargues found his method copied and distorted, led him to entrust the engraver Abraham Bosse with spreading his methods and defending his work. It was Bosse, who, in 1648, first published Desargues' perspective theorem that when two triangles are in perspective, their corresponding sides meet at points on the same collinear line. From 1644 onward Desargues turned his attention increasingly to architecture and the practical side of his graphical techniques. After returning to Lyon to work as an architect in 1649, he went back to Paris in 1657 and died there four years later.

See also Fermat, Pierre de; Geometry; Mathematics; Mydorge, Claude; Pascal, Blaise; Roberval, Gilles Personne de

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PHILIP BEELEY

DESCRIPTION OF THE HUMAN BODY

The *Description of the Human Body* (AT XI 223–86, extracts CSM I 313–24) was written in French in the winter of 1648 (see AT V 112, CSMK 329). The manuscript was published posthumously by **Clerselier** in 1664 with the *Treatise on Man*. It contains five unequal parts: a preface, a second part dealing with the movement of the **heart** and of the blood, the third with nutrition and aging, and the last two parts with the formation of the **animal**. The second part gives detailed anatomical and physiological explanations linked with the *Treatise on Man* and even more with the fifth part of the *Discourse on Method*, especially the relation to **Harvey's** demonstrations of the movements of the heart and of the blood in his Latin treatise of 1628. Some **explanations** are summarized in the first part of the *Passions of the Soul*. The *Description* was published with the subtitle "On the Formation of the Fetus," with Clerselier pointing out the importance of embryology or, in seventeenth-century terms, of the generation of animals. Descartes had given up explaining this question in the *Treatise on Man* (AT I 254, CSMK 39) but returned to it later (see his Latin fragments, *Thoughts about the Generation of Animals*, AT XI 505–38).

At the beginning of the *Description*, Descartes evokes the usefulness of the ancient motto "Know thyself," in order to cure illness and to prevent it, and also to avoid "attributing to the soul the functions which depend solely on the **body** and

on the disposition of its organs” (AT XI 223, CSM I 314). After defining the human **mind** in terms of **thought** (AT XI 224, CSM I 314), an echo of the *Meditations* and of the *Principles* I.9, Descartes gives an account of “the entire bodily **machine**” that establishes a dissociation between reasoning about **anatomy and physiology**, on the one hand, and teleological or theological considerations, on the other, as shown by the study of the **motion** of the heart and of the blood (AT XI 226, CSM I 315).

The laudatory approval of Harvey’s demonstration of the circulation of the blood, found in the *Discourse*, in the **correspondence** (AT IV 4 189), and in the *Passions of the Soul* I.7, is also detailed in the *Description* (AT XI 238–41, extract CSM I 316). Descartes says nothing about the Aristotelian philosophical framework in **medicine** on which Harvey still depended but insists on the validity of Harvey’s experimental proofs.

Descartes also details his disagreements with Harvey over the cause of the movement of the heart. He quotes **experiments** (including vivisection) to maintain that the expulsion of the blood must coincide with the expansion and not with the contraction of the heart. And he rejects the common view that “some faculty” causes this movement, emphasizing the importance of the heat in the heart but distinguishing it from Aristotle’s account (AT XI 241–45, CSM I 316–19). The importance of the circulation of the “**animal spirits**,” that is, the most subtle particles of blood, is to be noted.

Descartes’ embryology is characterized by a mechanical explanation of the order of the generation of the different organs and the importance devoted to the formation of the heart. Mechanical forces explain the development of all the parts of the body from the mix of the semens of the male and the female in utero and the heat present there.

Linked with the *Treatise on Man*, this text had a great influence on the development of mechanism in medicine. As for Cartesian embryology, it should be noted that in 1672 De Graaf proved the existence of ovaries and eggs in mammalian females and that in 1677 Leeuwenhoek, thanks to his microscopes, discovered the existence of spermatozoa. These discoveries led to many controversies in a period when physicians were trying “to explain the mystery of generation, still deeply surrounded by clouds,” as Dionis wrote in 1706 (p. 273).

As for the animal spirits, though Harvey had written, in his *Second Letter to Riolan (the Younger)* (1649), that the blood is not changed into spirits, animal spirits were still important in medical treatises as well as in the works of **Hobbes** (*Short Tract, De Homine, Decameron physiologicum*), **Malebranche** (*The Search for Truth*), Bossuet (*De la connaissance de soi-même*), and **Rohault** (*System of Natural Philosophy*). Théophile Bordeu made fun of them in his thesis defended in Montpellier in 1742 and recommended that they be abandoned. Later, Haller demonstrated the contractility of muscle fibers and the sensibility of the nerves without appealing to such spirits (*Elementa physiologiae corporis humani*, 1757–66).

See also Anatomy and Physiology; Animal Spirits; Body; *Discourse on Method*; Experiment; Harvey, William; Heart; Machine; Medicine; Mind; *Passions of the Soul*; *Treatise on Man*

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ANNIE BITBOL-HESPÉRIÈS

DESGABETS, ROBERT (1610–1678)

Born in Ancemont, France, Desgabets was a Benedictine monk who taught and defended Cartesian **philosophy** after Descartes' death in 1650 until his own death in 1678. His published works of philosophical interest are *Considérations sur l'état présent de la controverse*, his development of Descartes' views on the Eucharist, and *Critique de la Critique de la recherche de la vérité*, his criticism of **Simon Foucher's** criticism of **Malebranche's** *Search after Truth*. His work on the Eucharist heightened the worry that **Cartesianism** conflicted with the teachings of the church (his Benedictine superiors forced him to renounce this work). And his criticism of Foucher displayed fundamental misunderstandings of Malebranche's *Search*, leading Malebranche to react with disappointment to what he had expected to be a defense of his views.

Desgabets' published works might lead one to think him a controversialist who had no developed philosophical view of his own. In fact, however, Desgabets wrote several unpublished works that were widely circulated at the time, and these works reveal a distinctive philosophical system. We now have these works in *Dom Robert Desgabets: Oeuvres philosophiques inédites*, a collection that includes *Traité de*

l'indéfectibilité des créatures and the particularly important *Supplément à la philosophie de Monsieur Descartes*.

Desgabets' philosophical system differs from that of Descartes sufficiently for one to dispute whether we should call him a Cartesian (some call him a "radical Cartesian" [Schmaltz 2002]). Desgabets rejects Descartes' **method of doubt** on the grounds of a principle of intentionality according to which we cannot think of what does not exist. For the same reason he rejects Descartes' proofs of the **existence of God** and the physical world as being unnecessarily obscure and complicated, since the very fact that we can think of God and the physical world suffices to establish their **existence**. He also rejects Descartes' attempt to understand the nature of the soul by appealing to a pure intellection that completely divorces the soul from the **body** on the grounds that all our thoughts depend on the body. Further, he says that there is only one physical **substance** and, on one interpretation, only one mental substance; he says that substances are "indefectible," by which he means that they have a timeless existence that not even God can destroy (so there is no need for God to conserve them and no need to argue that the soul is immortal once it is established that the soul is a substance). Finally, on a common interpretation, Desgabets is an empiricist (see, e.g., Cook 2008).

Nevertheless, Desgabets consistently styles himself a Cartesian who uses Descartes' own principles to correct the (admittedly numerous) flaws in Descartes' work. Desgabets thinks that unnoticed **prejudices** led Descartes to errors and to fail to push his principles far enough. As Desgabets says, Descartes himself is not always a good Cartesian. The *Supplément* supplements Descartes' *Meditations* by stressing the basic principles to be drawn from the latter, criticizing Descartes for straying from them, and showing what follows from them. So, for example, he thinks that in places Descartes clearly assumes the basic principle that we cannot think of what does not exist. And he stresses in particular Descartes' doctrine of the creation of the **eternal truths**. Desgabets believes that this "beautiful" doctrine, only imperfectly understood by Descartes, can be purified through the use of resources within Descartes' philosophy, and that a proper appreciation of the doctrine leads to the insights that substances are indefectible and that we cannot think of what does not exist.

See also Cartesianism; Malebranche, Nicolas; Régis, Pierre-Sylvain; Soul, Immortality of the; Substance; Eternal; Truth

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MONTE COOK

DIGBY, KENELM (1603–1665)

Born at Gayhurst, Buckinghamshire, this Roman Catholic courtier with a reputation as an alchemist was a proponent of the view that physical phenomena can (and should) be explained only in terms of mechanistic qualities like size, **shape**, and **motion**. This is, of course, a Cartesian (and Hobbesian) view, but Digby (1644, 344, 346) claimed that it was also Aristotle's view and that the more traditional understanding of Aristotle (as offering scientific **explanations** that appeal to **substantial forms**) was a result of the distortions of the Scholastics. Digby believed that Roman Catholicism was the only guarantor of truth, but since he was persuaded that the mechanical philosophy of Descartes or **Thomas Hobbes** was correct, he decided that Aristotle's authority could be maintained only by interpreting it as an essentially mechanistic philosophy (Henry 2009, 43–75). Digby was active in intellectual circles, publishing the mammoth *Two Treatises* in 1644, among other tracts. He was an early member of the Royal Society, and over the course of his career he engaged with Hobbes, **Robert Boyle**, **Marin Mersenne**, **Pierre Gassendi**, **Isaac Beeckman**, **Walter Charleton**, and Descartes, among other important figures (Dobbs 1971, 25; Westfall 1958, 16).

The *Two Treatises*, Digby's landmark work, attempts to illustrate the power of mechanistic science but also aims to buttress the view that souls are immaterial. Digby's thought here is this: if all physical phenomena can be explained in terms of matter in motion, but certain aspects of rational souls cannot be so explained, then rational souls are not "physical phenomena." If rational souls cannot be explained

by matter in motion, then they are immaterial. Furthermore, if destruction or (in Aristotle's phrase) "passing away" is explained in terms of a dissolution and scattering of the particles of matter that constitute a thing, then souls must be immortal because, being immaterial, they are not constituted of material atoms (1644, preface).

Digby and Descartes (AT VIIIA 25, CSM I 210–11) agree that the existence of mental qualities cannot be explained in terms of qualities like size, shape, and motion and are thus the qualities of an entirely different **substance**. Descartes (AT IV 291–92, CSMK 265) and Digby (1644, 453) also hold that matter is a relatively low-grade sort of being and that minds are much more exalted. Still, Digby was in many respects not a Cartesian. Where Descartes famously accepted the Copernican model of the solar system (AT XI 68–71), Digby subscribed to a version of the traditional geocentric model (Digby 1644 154–56; Dobbs 1971, 3). Digby and Descartes also disagreed on important methodological issues, for example, on the role of experience and confirmation in the sciences (Digby 1644, 4–5; Dobbs 1971, 14). Digby argued that **physics** should not be *a priori* even if the results of physics would thereby be less than completely certain.

See also Explanation; Mind; Physics; Soul, Immortality of the

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DINET, JACQUES (1584–1653)

Born in Moulins in 1584, Dinet joined the Society of Jesus in 1604 and spent his noviciate period in Nancy; he studied **philosophy** in Pont-à-Mousson and became tutor of poetry and rhetoric at the College of Rouen (1607–10), after which he studied theology at La Flèche, where he was prefect of studies until 1614, at the time when Descartes was a student there. After a year of religious probation in Paris (1614–15), he received various appointments in **Jesuit** establishments: preacher in Rouen, Blois, Bourges, and Orléans; professor in Rennes, rector of the Colleges of Orléans (1620–23) and Rennes (1628–31); and, later on, provincial of France (1639–42) and of Champagne (1643–47). He was confessor to Louis XIII (March–May 1643) and assisted the king at his deathbed; subsequently he was confessor to young Louis XIV (June–December 1653). He died in Paris in 1653.

Descartes appealed to Dinet in his capacity as provincial of the French Jesuits to arbitrate his polemics with **Pierre Bourdin**, author of the Seventh Objections (AT III 468), for which Descartes was grateful (“I am much obliged to the R[everend] F[ather] Dinet for the frankness and prudence he made use of on that occasion” [AT III 596]). Descartes also thanked him for his support when, during his voyage to Paris in 1644, Dinet organized a reconciliatory meeting between Descartes and Bourdin (“I know it is you in particular that I owe the happiness of this agreement; and I am therefore particularly indebted to you for it” [AT IV 143]) and in 1644 sent copies of the *Principles of Philosophy* to Bourdin to circulate among the Jesuits, including Dinet himself (AT IV 143).

It was Dinet whom Descartes chose as witness to his first great polemical writing, *Letter to Father Dinet*, which was published together with the second edition of the *Meditations* (a copy of which **Huygens** already saw on May 26, 1642 [AT III 788]), and in which he compares the “calumnies” of Bourdin to the attacks by **Gysbertus Voetius** against the Cartesian program of studies at the University of Utrecht. Although personally sent to the Jesuits, the *Letter to Father Dinet* remained unanswered in writing, which made Descartes think that the Jesuits were waiting for his complete philosophy to be published (“I reckon they will not make public their opinion, whether for or against, until my philosophy is published,” [January 4, 1643, AT III 609]). It was probably in view of this that Descartes published the *Principles of Philosophy* (1644). Meanwhile, in Utrecht, the *Letter to Father Dinet* added a poisonous edge to the polemics between Voetius and **Regius** and contributed to the onset of the *querelle d'Utrecht*.

See also Bourdin, Pierre; Jesuit; *Objections and Replies*; Regius, Henricus; Voetius, Gysbertus

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VLAD ALEXANDRESCU

DIOPTRICS

The *Dioptrique*, often translated as the *Optics* or, more literally, as the *Dioptrics* is one of Descartes' earliest works. Likely begun in the mid- to late 1620s, Descartes refers to it by name in a letter to **Mersenne** of November 25, 1630 (AT I 182, CSMK 29). Its subject matter partially overlaps with Descartes' more foundational project *The World (or Treatise on Light)* in which he offers a general mechanistic account of the universe including the formation, transmission, and reception of **light**. Although **Galileo's** condemnation by the church prompted Descartes to abandon, in 1633, his plans for publishing *The World*, he continued in the ensuing years to vigorously pursue other scientific projects, including projects related to his work in **optics**. He was eventually persuaded to publish three essays highlighting some of his discoveries together with an introductory essay concerning "the method for rightly directing one's reason and searching for truth in the sciences" (AT VI 1, O 3). As one of those essays, Descartes' *Dioptrics* finally appeared in print together with the *Discourse on Method*, the *Meteors*, and the *Geometry* in the summer of 1637 in a French-language edition. It was republished in a Latin edition (without the *Geometry*) in 1644.

The subject matter of the *Dioptrics* may be thought of as covering three main topics and is formally divided by Descartes into ten chapters or "discourses." The first main topic concerns the nature of light and the laws of optics. In the first discourse, Descartes invites his readers to "consider light as nothing else ... than a certain movement or action, very rapid and very lively, which passes toward our eyes through the medium of the air and other transparent **bodies**" (AT VI 84, O 67). In

the second discourse, Descartes attempts to derive the law of reflection (known since antiquity) and the law of refraction (first published in the *Dioptrics*) through a series of ingenious, mechanistic analogies to the behavior of tennis balls reflecting off of hard surfaces and puncturing thin sheets of cloth (see **analogy**).

The second main topic of the *Dioptrics* concerns human vision. In the third discourse, Descartes offers an anatomical description of the parts of the eye, including the pupil, the interior “humors,” and the optic nerve. In the fourth, he provides an account of the senses in general, explaining “how the **mind**, located in the brain” comes to receive “impressions of external objects through the mediation of the nerves” (AT VI 109, O 87). The fifth discourse explains how light enters through the pupil of the eye, is refracted by the interior humors, and forms an inverted image on the retina at the back of the eye. The sixth discourse identifies various qualities by which objects of sight are apprehended, provides an account of our visual **perception** of distance, and highlights several ways in which human vision is systematically prone to error.

The third main topic of the *Dioptrics* concerns the improvement of human vision. In the opening paragraph of the seventh discourse, Descartes notes that the quality of human vision depends on three “principles” – namely visible objects; external organs, including all bodies “that we can place between the eye and object”; and interior organs such as the brain and nerves (AT VI 147–48, O 114). Prudently focusing his attention on how our external organs might be supplemented to maximize the distinctness, size, strength, and range of visual images, Descartes offers in the eighth discourse an account of “the **shapes** that transparent bodies must have in order to divert rays through refractions in every way that is useful to sight,” while in the ninth discourse he puts those results to practical use in explaining how our visual faculties may be extended through the construction of microscopes and telescopes (AT VI 165, O 127). Finally, the tenth discourse describes an ingenious, if ultimately impractical, method for cutting lenses and intriguingly suggests that, while telescopes may be esteemed insofar as they “promise to lift us into the heavens,” microscopes may in fact prove more useful since “by means of them we will be able to see the diverse mixtures and arrangements of the small particles which compose the **animals** and plants, and perhaps also the other bodies which surround us, and thereby derive great advantage in order to arrive at the knowledge of their nature” (AT VI 226, O 172).

Owing to an indiscretion by **Jean de Beaugrand**, then secretary to the French chancellor, a copy of Descartes’ *Dioptrics* was passed on to **Pierre Fermat** and other critics prior to its being licensed to appear publicly (Clarke 2006, 169). It can thus be said that Descartes’ masterpiece of geometrical optics has inspired praise, analysis, and disparagement since even *before* its (official) publication. Today, scholars continue to wrestle with Descartes’ account of light and his derivations of the laws of reflection and refraction (Shapiro 1974, Schuster

2000). There is great interest in his account of the physiology of vision, how that account fits into his larger philosophical system, and its influence on later thinkers such as **Nicholas Malebranche** and George Berkeley (Wolf-Devine 1993, Atherton 1990) (see **anatomy and physiology**). Finally, scholars have continued to return to Descartes' *Dioptrics* for insight into his multifaceted understanding of the relationship between method, theory, and practical application (Garber [2000] 1993, Ribe 1997).

See also *Discourse on Method*; Experiment; Explanation; Fermat, Pierre de; Galilei, Galileo; Golius, Jacob; Hydrostatics; Kepler, Johannes; Law of Nature; Light; *Meteors*; Method; Mydorge, Claude; Newton, Isaac; Optics; Perception; Physics; Rainbow; *The World*

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JEFFREY MCDONOUGH

DISCOURSE ON METHOD

In the aftermath of **Galileo's** condemnation for upholding the **motion** of the earth, Descartes decided that he would not publish *The World*, containing the condemned proposition, or anything else that might be controversial: "This so startled me that

I almost resolved myself to burn all of my papers, or at least not to let anyone see them.... There are already so many plausible opinions in **philosophy**, which can be upheld in debate, that if mine do not have anything more certain and cannot be approved of without controversy, I never want to publish them” (AT I 270–72, CSMK 40–41). But he continued to work on his scientific treatises, and his friends urged him to reconsider his decision. Ultimately, he determined “that it was easy for me to choose some matters that, without being subject to much controversy nor obliging me to declare more of my principles than I desire, would nevertheless allow me to show quite clearly what I can or cannot do in the sciences” (AT VI 75, CSM I 149). Thus, in October 1635 Descartes decided to publish the *Dioptrics*, adding the *Meteors* to the project in November, and resolving to set off the two treatises with a short preface. The project took greater shape in March 1636 when Descartes reported that he would include some other works as well; as he said, he wished to publish anonymously “four Treatises all in French, and the general title will be: *The Project of a Universal Science that can Elevate our Nature to its Highest Degree of Perfection. Then the Dioptrics, Meteors, and Geometry, in which the most curious Matters that the Author could have chosen to serve as proof of the universal Science he proposes are explained in such a way that even those who have never studied can understand them.*” At this time, he was representing the introductory materials as: “In this *Project* I reveal a part of my **Method**, I undertake to demonstrate the existence of **God** and of the soul separated from the **body**, and I add to it several other things I believe will not be unpleasant to the reader” (AT I 339, CSMK 51). Clearly, the plan grew from there, Descartes perhaps also making good on an old promise to provide an account of his intellectual accomplishments; as one of his friends had reminded him: “However, sir, please remember about the *Story of Your Mind*. It is awaited by all your friends, and you have promised it to me.... It will be enjoyable to read your various adventures in the middle and highest region of the air, to consider your achievements against the Giants of the School, the road you have taken, the progress you have made in the truth of things, etc.” (AT I 570–71).

Eventually, Descartes published the work as *Discourse on Method for Conducting One’s Reason well and for Seeking the Truth in the Sciences*, in six parts, together with *Dioptrics, Meteors, and Geometry*. He stressed that he called the work not *Treatise on Method* but *Discourse on Method*, because that means the same as *Preface* or *Notice on Method*; as he said, he “had no plan to teach the method but only to discuss it.” Descartes added that he referred to the treatises that followed as *Samples (Essais) of this Method* because “the things they contain could not be discovered without the method.” He also indicated that he “inserted some things of **metaphysics, physics, and medicine**,” in *Discourse*, parts 4–6, “to show that the method extends to all kinds of subjects” (AT I 349, CSMK 53).

In the introductory materials (*Discourse*, 1–3), Descartes affected the pose of the skeptic, in the manner of Michel de Montaigne and **Pierre Charron**, repeating

some commonplaces from Renaissance humanism. Against the giants of the schools, he opined: “In my college days I learned that nothing can be imagined which is too strange or incredible to have been said by some philosopher” (AT VI 16, CSM I 118). He also borrowed the analogy between reading and traveling belonging to the concept of erudition and history acclaimed by humanists but replied with his own general critique of humanist methods: “One who spends too much time traveling eventually becomes a stranger in his own country; and one who is too curious about the practices of past ages usually remains quite ignorant about those of the present” (AT VI 6, CSM I 114). There is a strong echo of this critique in Descartes’ unfinished dialogue *Search after Truth*, one of whose main themes is that curiosity, which is common to all people, is an illness that cannot be cured. Another aspect of Renaissance philosophy that Descartes espoused is its critique of logic and **syllogism**, in the context of setting out his rules of method, what he will later call “his logic”: “They serve rather to explain to someone else the things one already knows, or even ... to speak without **judgment** on matters of which one is ignorant, rather than to learn them” (AT VI 17, CSM I 119). And Descartes completed the first half of the *Discourse* with a “provisional code of morals,” clearly indebted to the same Pyrrhonist and neo-Stoic humanist sources. Descartes’ first maxim, “to obey the laws and customs of my country” (AT VI 22–23, CSM I 122), had been trumpeted by Montaigne and Charron as “the rule of rules, and the general law of laws.”

Descartes began sending numerous copies of the *Discourse* in June 1637. Among the recipients was one of his old teachers, to whom he described the volume “as a fruit that belongs to you, whose first seeds were sown in my mind, just as I also owed to those of your Order the little knowledge I have of letters” (AT I 383). The attempt to promote his works by making them the focus of discussion was already part of Descartes’ strategy. In part 6 of the *Discourse*, he announced: “I would be very pleased if people examined my writings and, so that they might have more of an opportunity to do this, I ask all who have objections to take the trouble and send them to my publisher and, being advised about them by the publisher, I shall try to add my reply at the same time” (AT VI 75, CSM I 149). Of course, Descartes did request objections from his teacher and from others of his order. But only a few people sent in objections. Descartes was asked whether foreigners formulated better objections than the French. He replied that he did not count any of those received as French other than those of **Jean-Baptiste Morin**. He referred to a dispute with Pierre Petit, which he dismissed, saying that he did not take Petit seriously but simply mocked him in return. He then listed the objections of the foreigners: **Libertus Fromondus** from Louvain and his colleague **Plempius**, an anonymous **Jesuit** (Jean Ciermans), and someone from the Hague (AT II 191–92). Still the objections by Petit seems to have rankled him, prodding him to write the *Meditations* in response. A recently discovered letter indicates that, until very late, the *Meditations* was intended to be introduced by a Latin translation of *Discourse*, part 4, and then a preface responding

to Petit; Descartes removed these and inserted instead the Preface to the Reader with which we are familiar: “I was forced to soften what I had written about Mr. Petit, as you will see in the preface to the reader, which I sent you to have printed, if you please, at the beginning of the book after the dedicatory Epistle to the faculty of the Sorbonne, and not to print the 4th part of the *Discourse on Method* or the small preface I put after it, nor the one that preceded the objections of the Theologian but only the Synopsis” (May 27, 1641; see Bos 2010, 295). Although plans for the objections and replies were shelved, the Latin translation of the *Discourse*, *Dioptrics*, and *Meteors* (without the *Geometry*, which was issued separately) was published as *Specimina philosophiae* in 1644.

See also *Dioptrics*, *Experiment*, *Geometry*, *Meteors*, *Meditations on First Philosophy*, *Method*, *Syllogism*, *The World*

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ROGER ARIEW

DISTINCTION (REAL, MODAL, AND RATIONAL)

Descartes famously claims that **mind** and **body** are really distinct **substances**, a view known as substance **dualism** (AT VII 78, 169–70; CSM II 54, 119–20). This claim is part of a larger theory of distinctions, which has both a metaphysical and an epistemological side. On the one hand, it explains what kinds of entities there are in the world and how they are related to each other; on the other, it also spells out how we can gain **knowledge** of these relations and how we are thereby able to provide an adequate description of the world – a description that fits not only **human beings** but also purely material substances (e.g., plants and animals) and purely mental substances (**God** and **angels**) as well as their **attributes** and **modes**.

The theory of distinctions has Scholastic roots. It was originally developed to resolve various theological puzzles (e.g., the connection between the three divine

persons and the relation between God's **essence** and his attributes) but soon became a general instrument for distinguishing different types of metaphysical relations (Adams 1987, 16–29). Descartes came to know it through late Scholastic authors, among them **Francisco Suárez** and **Eustachius a Sancto Paulo** (Ariew 2011), and used it primarily in a nontheological context (for an application to some theological problems, see Armogathe 1977). On his view, which he sets forth in detail in *Principles* I.60–62, there are three types of distinction.

First, there is a *real distinction*. It obtains between two or more substances, and we can recognize it “from the fact that we can clearly and distinctly understand one apart from the other” (AT VIIIa 28, CSM I 213). This is precisely the distinction that exists between mind and body, but also between two (or more) minds and, should there be more than one, between two (or more) bodies (see **individuation** and **substance**). All these items are substances, that is, complete, self-subsisting entities that need only the concurrence of God in order to exist (AT VIIIa 25, CSM I 210). That is why they are independent entities that can, but need not, be related to other entities in the world. Thus, a stone can be closely related to another stone, when it is used, for example, as a brick in a building, but continues to exist when the other stone is removed or even destroyed and is therefore really distinct from it. Likewise, a human mind can be joined with a body and is, as it were, “intermingled with it” (AT VII 81, CSM II 56), but it continues to exist when the body dies and decays (see **human being**).

Second, a lesser distinction obtains between a substance and any one of its “modes” (or accidental properties), or between two modes of the same substance. This is a *modal distinction*, which we can recognize “from the fact that we can clearly perceive a substance apart from the mode which we say differs from it, whereas we cannot, conversely, understand the mode apart from the substance” (AT VIIIa 29, CSM I 214). This type of distinction can be found in the material as well as in the mental realm. Thus, we recognize that a stone can exist without a particular motion but not vice versa. Likewise, we realize that a mind can exist without a particular act of thinking but not vice versa. In all these cases, there is a one-sided dependence relation: a mode depends on a substance, whereas a substance does not depend on a mode. Even if we focus on two modes of the same substance, for example, on the **motion** and the **shape** of a stone, we detect a one-sided dependence relation because these modes cannot stand on their own; they need the stone as the subject “in which they inhere” (ibid.). Consequently, they need to be specified as stone-motion and stone-shape. The motion of another substance, for example, of an arrow, is really distinct from both the stone-motion and the stone-shape because it depends on a completely different substance. Similarly, two acts of thinking by the same mental substance are only modally distinct because they inhere in the same subject, whereas two acts of two different mental substances are really distinct.

Third, there is a *conceptual distinction* or distinction of reason (*distinctio rationis*) that does not involve any kind of dependence relation. It obtains between a substance and some of its attributes or between two attributes of a single substance. It is recognized “by our inability to form a clear and distinct idea of the substance if we exclude from it the attribute in question, or, alternatively, by our inability to perceive clearly the idea of one of the two attributes if we separate it from the other” (AT VIIIA 30, CSM I 214). This kind of distinction can, again, be found both in the material and in the mental realm. Descartes gives a clear example: if one thinks about the substance of a stone and its duration, one cannot detect two items that would stand in a mutual or a one-sided dependence relation. The duration of the stone is nothing but the substance itself insofar as it exists for a certain time. When we focus on the duration and distinguish it from the stone, it is our mind that introduces a distinction that is not given in the material world. And when we describe order and number as additional attributes, it is again our mind that draws a distinction that lacks distinct relata in the extramental world (see Nolan 1997). That is why all of the attributes of material substances are only conceptually distinct. Likewise, if we refer to thinking as an attribute – even the principal attribute – of our own mind and distinguish it from the mind itself, we merely introduce a conceptual distinction.

Descartes’ taxonomy of distinctions lacks one type found among Scholastic authors, namely the formal distinction, as **Caterus** (the author of the First Set of Objections) remarked (AT VII 100, CSM II 72). This distinction, famously introduced by **John Duns Scotus**, was said to obtain between “realities” or “formalities” that always coexist in a given substance but can nevertheless be distinguished (Wolter 1990). For instance, God’s justice and his mercy were said to be formally distinct. Descartes does not, however, neglect this distinction that was thoroughly discussed by his Scholastic predecessors. In his reply to Caterus, he points out that the formal distinction is nothing but a modal distinction because it obtains between two modes of a substance (AT VII 120–21, CSM II 85–86). Thus, justice and mercy are nothing but just and merciful acts performed by God. Therefore, they are to be understood as modes depending on a substance. However, in the later *Principles* Descartes revises his answer, stating that there is “merely a conceptual distinction between the modes and the object which they are thought of as applying to” (AT VIIIA 30, CSM I 214). The modes he is referring to in this passage are not modes in the strict sense, that is, accidental properties, but rather essential features God displays. Therefore, they are to be understood as attributes (for this use of *modi*, see also AT IV 348–49, CSMK 279–80). That is, God’s justice is not an act of doing justice but the divine way of being just. Since all attributes are only conceptually distinct from each other and from their substance, justice and mercy as divine attributes are also conceptually distinct.

This **explanation** shows that Descartes uses a reductionist strategy when dealing with distinctions. He intends to limit all distinctions to three types that he takes

to be exhaustive and mutually exclusive (AT VIIIA 28, CSM II 213). Any other putative distinction can be reduced to one of them. Descartes' account of these three types also makes clear that he attempts to integrate the Scholastic scheme of distinctions, which was originally developed within the framework of an Aristotelian ontology, into his own substance-attribute-mode ontology.

It might seem, however, that Descartes appeals to more than three types of distinction, despite the fact that he mentions only three. In particular, it might seem that he recognizes two types of conceptual distinction (Hoffman 2002, 63). One type would be the already-mentioned distinction we introduce between an attribute that exists outside our mind (e.g., the duration of a stone) and a substance or between two attributes of this kind. Another type would be the distinction between an attribute that does *not* exist outside our mind (e.g., number or a **universal**) and another attribute of this kind. However, a closer look at the text reveals that Descartes does not accept attributes that exist only inside the mind. He explicitly holds that "number and all universals are simply modes of thinking" (AT VIIIA 27, CSM I 212). These modes should not be conflated with attributes. Should one ask, for instance, how the universals "man" and "animal" are related, Descartes' nominalist answer would be: there are no such things as the universal natures of humanity and animality; universals exist only in our mind (see Nolan 1998). But all that can exist in our mind are acts of thinking about men and animals. These acts are nothing but mental modes. Therefore, there is only a modal distinction between two (or more) universals. No additional type of distinction needs to be introduced.

What is the function of the theory of distinctions? Most obviously, it plays a crucial role in the argument for substance **dualism**. This becomes clear in the Sixth Meditation where Descartes explicitly mentions the real distinction. He remarks that he "can clearly and distinctly understand one thing apart from another" (AT VII 78, CSM II 54), namely the mind apart from the body; and whatever can be understood as being apart is capable of being separated, at least by God. That is why mind and body are really distinct, even though they happen to be closely related. The crucial point is that Descartes refers to mutual independence. Since he clearly and distinctly understands that there is neither a one-sided dependence relation (as it is the case with substances and modes) nor an identity relation (as is the case with substances and attributes), he realizes that the mind can exist without the body and the body without the mind. And because these two items are mutually independent, they are self-subsisting substances that need nothing but the concurrence of God to exist.

But why is Descartes so certain that mind and body are mutually independent and therefore really distinct? Couldn't he simply fail to see a dependence relation? Both Caterus and **Arnauld** made this point, arguing that mind and body might simply be two aspects of one and the same thing (AT VII 100, 201–2; CSM 72, 141–42). This objection neglects two important points. First, Descartes emphasizes that he

does not have just any kind of understanding of mind and body but a clear and distinct one. This type of understanding is always correct because God guarantees its truth, as he shows in the Fourth Meditation (AT VII 62, CSM II 43). It is therefore of crucial importance to follow the argumentative order of the *Meditations*. Descartes appeals to a clear and distinct understanding of a mutual independence and hence of a real distinction between mind and body only *after* the divine guarantee has been introduced (see **clarity and distinctness**). Second, the objection also neglects that Descartes does not simply understand mind and body as two aspects of one and the same thing. He makes clear that he understands each of them as “a complete thing” (AT VII 121, CSM II 86) – that is, as a self-sufficient thing that does not depend on anything else (see **substance**). But why is he able to understand mind and body in this way, thus setting them apart from properties that are incomplete things? In the Sixth Meditation, he gives a clear answer: he is able to do so because he understands each of them as a thing that has its own nature or essence (AT VII 78, CSM II 54). In fact, he is even able to understand what this essence amounts to: the mind is essentially a thinking thing, the body essentially an extended thing (see **thought** and **extension**). Given that these essences are mutually independent, the things characterized by them must also be mutually independent.

If one understands Descartes in this way, it is clear that it is an essentialist argument that provides the foundation for his thesis that mind and body are really distinct (Carriero 2009, 379–86). Since they are self-sufficient things that have their own essences, they depend neither on each other nor on some third thing (except for God, who constantly maintains them in **existence**). To recognize this fact, one simply needs to establish what their essence is. It is therefore hardly surprising that Descartes starts with a reflection on the nature or essence of mind and body, as the title of the Second Meditation makes clear (AT VII 23, CSM II 16), before he spells out their relation. Only an insight into their essences, not just into their existences, can reveal whether they are self-sufficient and therefore really distinct substances.

It is also important to take the essentialist argument into account to understand the separation thesis. Descartes clearly affirms that mind and body can be set apart, and he even uses this premise to argue for the immortality of the mind (AT VII 153, CSM II 108). Put in a nutshell, this argument amounts to the following claim: since the mind can be set apart from the body, it can survive the death of the body (see **soul, immortality of the**). However, this separation thesis is, strictly speaking, a separability thesis. Descartes does not claim that mind and body *are* separated but affirms only that they *can* be separated. In fact, he even insists that they are not separated in this life but are closely related and “united in a real and substantial manner” (AT III 493, CSMK 206). If there were no union, there would be no sensory **perceptions** and **passions** because the mind alone, being by its essence a thinking substance, could have no states that are anchored in the body (see **human**

being). Note also that separability alone does not guarantee the immortality of the mind. The mind could be detached from the body at the moment of death but then decay on its own, for example, because there is an internal dissolution. To avoid this consequence, Descartes introduces a further qualification. Not only can the mind be set apart from the body, but it is also a “pure substance” that has no parts and therefore cannot be dissolved (AT VII 14, CSM II 10). This contrast between mind and body as pure and impure substances shows again that their essences set them apart. Only the body that is essentially an extended thing consists of many parts (or, more precisely, of an infinite number of corpuscles) and can therefore be dissolved. Finally, the separability of mind and body is not the reason for their real distinction. It is rather the other way round; they are separable because they are really distinct (Rozemond 1998, 3–12). What makes them distinct and therefore separable are their mutually exclusive essences. And these essences are not defined in modal terms. That is, Descartes does not say that the essence of a substance is a bundle of essential properties that a substance necessarily has (as opposed to those it only contingently has) and that is, as it were, always glued to the substance. An essence is in no way added to a substance. It is rather something like its internal structure – something that is only conceptually distinct from the substance.

Important and indispensable as the theory of distinctions is for the explanation of the mind-body relation, it is not its only function. It has a broader scope because it is also meant to explain the relation between substances (both mental and material) and their properties. Following Aristotle, Scholastic authors distinguished between essential and accidental properties and claimed that accidental ones – for instance, color and shape – are entities that are said of substances and exist in them. But what does it mean to be *in* a substance? Scholastic authors usually explained this relation by appealing to inherence: since color and shape are not self-subsisting entities, they need to have a bearer or underlying subject. This is precisely the substance in which they are located and on which they depend. Given that they are not part of the essence of the substance, they can be added to it or taken away from it. Inspired by theological debates about **transubstantiation**, some Scholastic authors even assumed that accidental properties can be supernaturally separated from a substance and added to another one (Adams 1991). Thus, when a piece of bread supernaturally becomes the body of Christ, the color that first existed in the bread comes to exist in another substance and inheres in it as in its new subject. Some Scholastics, including Peter of John Olivi, even thought that the color and the shape of the bread can remain without inhering in any subject. They were thus led to posit “real qualities” – that is, entities that can have independent existence (Normore 2010, 681).

It is precisely this conception of independent entities, which can be combined with others like tinkertoys, that Descartes rejects when he scornfully remarks that **real qualities** are “nothing but chimeras” (AT III 212). If there were such qualities, they would be self-subsistent and hence autonomous entities – that is, substances

that can be but need not be attached to other substances (AT III 430, CSMK 194). Consequently, they would be really distinct from the substances in which they happen to exist. On Descartes' view, this conception neglects the basic fact that accidental properties cannot exist on their own, neither naturally nor supernaturally. They are always dependent entities. That is why they can be nothing but modes – that is, ways of being of a substance. That they “inhere” in a substance, as Descartes says using traditional terminology (AT VIIIA 29, CSM I 214), simply means that they modify it. Thus, the round or square **shape** of a material substance is nothing but its way of being. Should the substance be destroyed or supernaturally transformed into another one, its way of being such-and-such would inevitably also be destroyed or transformed. Given this intimate relation, an accidental property is only modally distinct from the substance on which it depends. This is true for immaterial as well as material things. Acts of perceiving or willing are also just modes of an immaterial substance – that is, ways of being a thinking thing. For instance, when someone is thinking about an apple, there is no special entity added to the substance as a “real quality” but simply a specific way of being that substance.

It is of crucial importance for Descartes that it is not only impossible for a mode to exist without a substance but equally impossible for us to conceive of a mode without a substance. In the *Comments on a Certain Broadsheet*, he points out that “although we can readily understand a substance apart from a mode, we cannot *vice versa* clearly understand a mode unless at the same time we have a conception of the substance of which it is a mode” (AT VIIIB 350, CSM I 298). Thus, we can conceive of a mental substance without understanding that it is right now thinking about an apple, but we cannot make sense of this act of thinking without understanding that it is the act of a mental substance: a mode can never be understood as an independent entity. That is why there can be only a modal distinction, not a real one, between an immaterial substance and its act of thinking.

To be sure, Descartes was not the first author who referred to the modal distinction as a special type of distinction. John Duns Scotus mentioned it, and Francisco Suárez explicitly distinguished it from the real distinction to make clear that some accidental properties are necessarily dependent on substances and can never be separated from them (Menn 1997; Normore 2010, 683–85). According to Suárez, these properties are “real modes that are something positive and affect these entities [i.e., the substances] through themselves by giving them something that is outside of the full essence” (*Disputationes metaphysicae* VIII.1.17). But Suárez hastened to add that only some accidental properties (his example was the inherence relation) are modes, whereas others are real qualities. At this point Descartes goes beyond his Scholastic predecessors. On his view, *all* accidental properties are nothing but modes. There is nothing they could give or add to the essence of a substance because they have no essence on their own. In a letter to **Regius**, Descartes remarks: “Now we do not deny active qualities, but we say only that they should not be regarded as having any

degree of reality greater than that of modes; for to regard them so is to conceive of them as substances” (AT III 503, CSMK 208; cf. AT III 430, CSMK 194). This remark shows that Descartes intends to avoid the “upgrading” of accidental properties to independent entities that have their own essence. Consequently, he rejects the traditional substance-quality ontology and replaces it with a substance-mode ontology. This change becomes manifest in his reference to a modal distinction.

The theory of distinction sheds light on another ontological issue. As has become clear, the conceptual distinction is, strictly speaking, not an ontological distinction because it does not obtain between two entities. It is a distinction our mind introduces when it separates attributes or aspects that are not separated in reality. But how are we able to do that? Descartes’ answer is clear: by a process of **abstraction** (Murdoch 1993). This is a mental operation that consists in concentrating one’s attention on one aspect while ignoring or even “turning one’s thought away” from other aspects (AT III 475, CSMK 202). It amounts to a “selective attention” (Nolan 1997, 133) and depends solely on the mind that decides to focus on a certain aspect. Descartes illustrates this process with the example of the essence and existence of a substance. How do we separate these two aspects? We “understand the essence of a thing in one way when we consider it in abstraction from whether it exists or not, and in a different way when we consider it as existing; but the thing itself cannot be outside our thought without its existence, or without its duration or size, and so on” (AT IV 349, CSMK 280). The important point is that essence and existence are not two components or parts of a thing that we detect and then take apart. In the thing itself, there is no distinction between essence and existence, as Thomas Aquinas and other Scholastic authors assumed (Wippel 1984). We introduce a distinction when we focus on the essence and turn our thought away from the existence.

This has an important consequence for understanding the attributes. Even the principal attributes – extension for material substances and thought for immaterial ones – are not components or parts of a substance. They are only aspects – structural aspects, one may say in modern terminology – we describe when we try to understand what being a material or an immaterial substance amounts to. In reality, there is no distinction between a substance and its principal attribute. It may therefore be misleading to say that a material substance *has* extension, similar to the way it has many modes. It is more appropriate to say that such a substance simply *is* (a piece of) extension (Normore 2008). In the *Principles*, Descartes explicitly holds that people who draw a distinction between material substance and extension “do not understand anything by the term ‘substance’” and mistake extension for an accident (AT VIIIa 45, CSM I 226–27). They falsely assume that extension is a mode or, even worse, a real quality that is somehow compounded with the substance. The distinction between material substance and extension exists only in our mind, not in extramental reality.

The fact that we can (and often do) distinguish attributes that are not distinct entities in reality shows that there is no one-to-one correspondence between our way of conceiving of things and the things themselves. In fact, one of Descartes' aims is to guard against a naïve ontological picture that assumes such a correspondence. Our conceptual apparatus is much richer and more fine-grained than the catalog of basic entities, which includes nothing but substances and modes. In making this point, Descartes follows a nominalist tradition that attempts to avoid proliferating entities unnecessarily and explains the variety of aspects and attributes we describe in the world as a mere variety of conceiving of the world (on the nominalism, see Nolan 1997; Secada 2000, 215–35).

See also Abstraction versus Exclusion; Dualism; Essence; Mind; Mode; Quality, Real; Scholasticism; Soul, Immortality of the; Substance; Transubstantiation; Universal

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DOMINIK PERLER

DIVISIBILITY

One of Descartes' arguments for **dualism** relies on the claim that whereas **mind** is by its nature indivisible, **body** is by its nature divisible (AT VII 86, CSM II 59). It is tempting to see this argument as affirming the simplicity of the human mind, but Descartes never calls the mind "simple." In this argument, he writes that "the whole mind seems to be united to the whole body" and that when a part of the body is removed, no part of the mind is removed. These claims imply the view he states explicitly elsewhere, namely, that the mind is whole in the whole body and whole in its parts (see **holenmerism**). He also denies that the **faculties** of the mind are parts of it; this claim is intended to deny a common Scholastic view, that the faculties of the soul are really distinct from it (see **distinction [real, modal, and rational]**). Descartes' statement of the indivisibility of the soul is not meant to deny all complexity in the soul: the soul does have **modes** that change over **time**. But he means to deny that there are any really distinct entities within the soul (Rozemond 2010).

It is natural to expect that Descartes uses this difference between mind and body as his ground for saying that the mind, unlike the body, is immortal, since this is a common line in the history of philosophy. But when he sketches an argument for immortality in the Synopsis to the *Meditations*, he does not argue this way (Rozemond 2010, Fowler 1999) (see **soul, immortality of the**). Instead, he argues that *both* mind and body are immortal in virtue of their status as **substances**:

First, we need to know that absolutely all substances, or [*sive*] things that must be created by **God** in order to exist, are by their nature incorruptible and cannot ever cease to exist unless they are reduced to nothingness by God's denying his concurrence to them. Secondly, we need to recognize that body, taken in general, is a substance, so that it too never perishes. (AT VII 13, CSM II 10)

So body is divisible, but it is not corruptible. For Descartes, something is divisible if it can be divided into parts that are of the same kind as each other and the whole. Corruption results in entities different in kind from the entity that is the starting point (see **substance**). So a body, when divided, results in further, smaller bodies, but it does not ever undergo a process that results in entities of a different kind.

This is a controversial passage, however. This is so mainly because there are complications around the issue of the divisibility of body, due to complications around the notion of body (see **body**, **individuation**, and **substance**). A body *qua* extended substance is divisible but not corruptible, according to Descartes. This is what in the Synopsis he refers to as “body taken in general,” although some see this phrase as referring to the entire physical world. Also in the Synopsis, Descartes writes that the human body *is* corruptible: a human body is not body *qua* extended substance, but it is a body with a specific structure, a body modified in specific ways. And elsewhere he explains that the human body “is a unity which is in a sense indivisible because of the arrangement of its organs, these being so related to one another that the removal of any one of them renders the whole body defective” (AT IX 351, CSM I 339).

Descartes relies on the divisibility of body to argue against **atoms** and for the claim that any two parts of matter are really distinct substances:

In the same way we can say that the existence of atoms, or parts of matter which have **extension** and are yet indivisible, involves a contradiction, because it is impossible to have the idea of an extended thing without also having the idea of half of it, or a third of it, and so conceiving it as being divisible by two or three. From the simple fact that I consider the two halves of a part of matter, however small it may be, as two complete substances, whose ideas are not made inadequate by an **abstraction** of my **intellect**, I conclude with certainty that they are really divisible. (AT 477, CSMK 202–3; cf. AT VIII 28, 51–52; CSM I 213, 231–32)

Finally, Descartes holds that bodies are sometimes actually indefinitely divided. He thinks this must be so in order to explain how **motion** is possible in a **plenum** (AT VIII 58–60, CSM I 236–39) (Garber 1992, 125–26).

See also Atom; Body; Dualism; Faculty; Holism; Individuation; Soul, Immortality of the; Substance; Vacuum

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MARLEEN ROZEMOND

DOUBT

Descartes writes that "the best way of achieving a firm **knowledge** of reality is first to accustom ourselves to doubting all things"; indeed, he recommends spending not merely "the short time needed" to read through the First Meditation program of doubt "but to devote several months, or at least weeks, to considering the topics dealt with" (AT VII 130, CSM II 94). When challenged by **Hobbes** – as to the originality of the skeptical arguments – Descartes replies that he "was not trying to sell them as novelties," but instead had a "threefold aim": first, to help distinguish what pertains "to the **intellect** ... from corporeal things"; second, to "reply to them [these skeptical arguments] in the subsequent Meditations"; and, third, "to show the firmness of the **truths** ... propound[ed] later on" (AT VII 171–72, CSM II 121).

There is unmistakable originality in Descartes' pursuit of each of these aims, along with his introduction of (arguably) new skeptical hypotheses with more far-reaching consequences than anything before. The first aim and especially the third are closely associated with the methodological character of Cartesian doubt – the so-called **method** of doubt. Accordingly, doubts are pursued as a means, not an end: unlike the skeptics "who doubt only for the sake of doubting," Descartes writes that his "aim was to reach **certainty**" (AT VI 28–29, CSM I 125). What follows is an overview of key elements of the method, emphasizing its use in the *Meditations*.

I. KNOWLEDGE AND DOUBT

The opening lines of the *Meditations* assert a connection between doubt and the foundations of knowledge:

Some years ago I was struck by the large number of falsehoods that I had accepted as true in my childhood, and by the highly doubtful nature of the whole edifice that I had subsequently based on them. I realized that it was necessary, once in the course of my life, to demolish everything completely and start again right from the foundations if I wanted to establish anything at all in the sciences that was stable and likely to last. (AT VII 17, CSM II 12)

What is the connection? Descartes understands knowledge in terms of certainty. His method renders certainty as the contrast of *doubt*: the greater the certainty the less the doubt, and vice versa. *Indubitable* conviction emerges as a necessary condition of full-fledged knowledge (*scientia*): “No act of awareness that can be rendered doubtful seems fit to be called knowledge” (AT VII 141, CSM II 101). Indubitable conviction is indeed a sufficient condition of knowledge:

Now if this conviction is so firm that it is impossible for us ever to have any reason for doubting what we are convinced of, then there are no further questions for us to ask: we have everything that we could reasonably want ... such a conviction is clearly the same as the most perfect certainty. (AT VII 144f, CSM II 103)

How does one achieve such knowledge? Descartes likens his approach to foundationalist methods in **geometry**. The knowledge claims “put forward first must be known entirely without the aid of what comes later; and the remaining items must be arranged in such a way that their demonstration depends solely on what has gone before” (AT VII 155, CSM II 110). This approach neatly generates further knowledge. But new questions arise. Where do the claims come from that are “put forward first”? On what is their certainty based? Addressing these questions is part of the method of doubt’s *raison d’être*:

Throughout my writings I have made it clear that my method imitates that of the architect. When an architect wants to build a house which is stable on ground where there is a sandy topsoil over underlying rock, or clay, or some other firm base, he begins by digging out a set of trenches from which he removes the sand, and anything resting on or mixed in with the sand, so that he can lay his foundations on firm soil. In the same way, I began by taking everything that was doubtful and throwing it out, like sand; and then, when I noticed that it is impossible to doubt that a doubting or thinking substance exists, I took this as the bedrock on which I could lay the foundations of my **philosophy**. (AT VII 56–57, CSM II 366)

Efforts at justifying first principles often invoke *self-evidence*, or **clarity and distinctness** – notions intended to suggest certainty. Yet these can seem highly subjective. As **Gassendi** notes, “Everyone thinks that he clearly and distinctly perceives the truth which he champions” (AT VII 278, CSM II 194). Methodic doubt is supposed to solve the problem. As Edwin Curley (1978, 85) explains, Descartes appreciates that his own appeals to “self-evidence will be dismissed by the skeptic as a matter of merely subjective conviction”; so he instead “adopts a negative procedure for

getting his first principles, the method of systematic doubt.” Descartes’ insight is that doubt can be “operationalized” in ways that certainty cannot. Accordingly, the method employs doubt as a tool for assessing proposed candidates for first principles.

This aspect of the method is on display in the First Meditation. Aristotelian doctrine proposes external sense as an appropriate basis for the foundations of knowledge. Descartes’ method first renders the proposal into a claim about doubt resistance, rather than about certainty. Though our senses sometimes deceive us,

there are many other beliefs about which *doubt is quite impossible*, even though they are derived from the senses – for example, that I am here, sitting by the fire, wearing a winter dressing-gown, holding this piece of paper in my hands, and so on. (AT VII 18, CSM II 12–13; emphasis added)

Thus rendered, the proposal is testable. On showing that such beliefs *are* undermined by doubt, the proposal is set aside.

Importantly, doubt’s role is not merely destructive, but constructive. Not only must the method undermine dubious proposals of first principles, but it must help to identify the real thing. When (and if) a basis of belief is discovered that cannot be undermined with doubt, this is an appropriate foundation of knowledge.

Descartes cleverly employs multiple skeptical arguments, of varying strengths, to help corroborate his nativist doctrines. All bases of belief – experiential and purely intellectual – are vulnerable to hyperbolic doubts. But if beliefs based on external sense turn out *more* vulnerable, then the method provides Descartes another tool in his campaign against empiricism.

2. THE SKEPTICAL DOUBTS

The First Meditation presents a variety of doubting arguments that unfold in increasing strength. The conclusions of each successive argument undermine what has already been called into doubt, plus more, thereby establishing a spectrum of certainty: propositions undermined only by more powerful doubts are more certain. Four doubts are especially prominent. Let us consider each in turn. (Note that there are wide-ranging disagreements about the interpretation of each. Some critics argue that the reasons for doubt cannot be formulated consistently [cf. Austin 1962, ch. 5; Bouwsma 1949]; others argue that they cannot be formulated without begging the question [cf. M. Williams 1995]; yet others argue that Descartes is not putting forward doubting *arguments* at all [cf. Carrierio 2009].)

a. Illusion-Based Doubt

The skeptical narrative is initiated with the claim that “the senses occasionally deceive us with respect to objects which are very small or in the distance” (CSM II 12, AT VII 18). A retrospective passage of the Sixth Meditation elaborates the claim:

Sometimes towers which had looked round from a distance appeared square from close up; and enormous statues standing on their pediments did not seem large when observed from the ground. In these and countless other such cases, I found that the **judgements** of the external senses were mistaken. (AT VII 76, CSM II 53)

This form of skepticism is the legacy of ancient Greek skepticism. Descartes makes no special effort to elaborate or defend such doubts, or to overcome them. He seems to hold that, in the final analysis, we remain vulnerable to illusion-based doubt.

b. Dreaming Doubt

The dreaming doubt derives from the intuitively plausible thesis that dreaming is, at its best, experientially similar to waking: “Every sensory experience I have ever thought I was having while awake I can also think of myself as sometimes having while asleep” (AT VII 77, CSM II 53). If, indeed, for *every* experience I have ever regarded as waking, an experientially similar dream is thinkable, then it is thinkable that my *present* experience is a dream. The conclusion seems to be that, for all I know, I am now dreaming. The First Meditation puts it this way:

I see plainly that there are never any sure signs by means of which being awake can be distinguished from being asleep. The result is that I begin to feel dazed, and this very feeling only reinforces the notion that I may be asleep. (AT VII 19, CSM II 13)

Importantly, the conclusion is neither that I *am* dreaming nor that I *believe* as much; rather, it is the epistemic claim that I do not *know* otherwise.

The epistemic impact is quite broad. The doubt undermines every belief that would not count as knowledge on the assumption I were now dreaming – including such aforementioned beliefs as “that I am here, sitting by the fire, wearing a winter dressing-gown, holding this piece of paper in my hands, and so on.” The broader First Meditation passage suggests that whole disciplines depending on the senses are thereby under suspicion of doubt – for example, “**physics**, astronomy, **medicine**” (AT VII 20, CSM II 14).

c. *Problem of the External World*

The dreaming doubt motivates what Bernard Williams (1978, 54) calls “the universal possibility of illusion” – for any particular experience, the objects in view might be illusory; a stronger skeptical worry concerns what he calls “the possibility of universal illusion” – the possibility that the totality of my experiences are illusory. Descartes extends his skepticism to the stronger claim, raising the so-called problem of the external world. According to Myles Burnyeat (1982), Descartes is the first philosopher to press skepticism this far.

We should clarify the relevant notion of externality, contrasted with internality. Roughly, the *internal* world encompasses those items of which the **mind** has immediate conscious awareness – namely, the mind’s own *ideas*, as Descartes calls them. The *external* world encompasses all else, including all **bodies** (even one’s *own* body) and all *other* minds. The skeptical problem of interest raises a doubt about the very **existence** of the external world: for all I know, my own (immaterial) mind is all that exists. That is, I can take seriously the possibility of radical solipsism.

The texts are unclear about the precise motivation of the doubt. Some texts implicate the evil genius (discussed in the next section) – “How do I know that he has not brought it about that there is no earth, no sky, no extended thing, no **shape**, no size, no place, while at the same time ensuring that all these things appear to me to exist just as they do now?” (CSM II 14, AT VII 21). Other texts link the problem with premises about dreaming:

Every sensory experience I have ever thought I was having while awake I can also think of myself as sometimes having while asleep; and since I do not believe that what I seem to perceive in sleep comes from things located outside me, I did not see why I should be any more inclined to believe this of what I think I perceive while awake. (AT VII 77, CSM II 53)

Whatever Descartes’ primary motivation, the problem of the external world endures as a powerful and influential skeptical problem. In contemporary discussions, the problem is often motivated by the so-called brain-in-a-vat hypothesis, itself inspired by Descartes’ philosophy.

d. *Evil Genius Doubt*

The foregoing reasons for doubt undermine judgments of external sense. According to Descartes, there are other judgments that survive intact: for example, “whether I am awake or asleep, two and three added together are five, and a square has no more than four sides” (AT VII 20, CSM II 14). A more powerful reason for doubt

is introduced to finish the job. Among the meditator's preexisting beliefs is that "an omnipotent **God** ... made me the kind of creature that I am" (AT VII 21, CSM II 14). Suppose this God created me with a defective cognitive nature: "God could have given me a nature such that I was deceived even in matters which seemed most evident" (AT VII 36, CSM II 25). This skeptical possibility generates a quite radical conclusion. For *if* I have a defective cognitive nature, then, for all I know, I am systematically in error; I may be mistaken even concerning the matters about which I seem the most certain. This is the evil genius doubt.

As we have here framed the evil genius doubt, the underlying worry is the possibility of our having been made with *cognitive defect*. Descartes allows that other skeptical possibilities – that is, those whereby we would "deny the existence of so powerful a God" – can generate the same underlying worry about cognitive defect: "The less powerful they make my original cause, the more likely it is that I am so imperfect as to be deceived all the time" (AT VII 21, CSM II 14; cf. *Principles* I.5). Understood as a doubt about cognitive defect, therefore, a specific role for an all-powerful deceiver is optional. Interpretations differ. On one alternative, the doubt gets its purchase specifically from the evil genius's supreme power. Some interpretations link the doubt to the doctrine of the creation of the **eternal truths** (cf. Wilson 1978, 33ff. and 120ff.; Kenny 1968, 36ff. and 196). And some distinguish the evil genius doubt from the deceiving-God hypothesis (cf. Gouhier 1937, 163).

On usual interpretations, the evil genius doubt secures a universal doubt. Careful reflection on the reasons for doubt is supposed to help us appreciate that everything we previously thought we knew is in fact subject to doubt. "So what remains true? Perhaps just the one fact that nothing is certain" (AT VII 24, CSM II 16) – that is, for the time being.

3. DOUBT AND FIRST-PERSON INQUIRY

The *Meditations* unfolds as a first-person narrative. As Bernard Williams (1978, 19) observes, the work is "not a description but an enactment of philosophical thought." For instance, to appreciate fully the *cogito's* doubt resistance, readers must enact the *cogito*, reflecting on their *own* thinking. Suppose it were otherwise – for example, try running the *cogito* in the third person: "Descartes is thinking, therefore Descartes exists." Granted, Descartes' existence follows from his thinking. Certainty that he *is* thinking, however, is available only via first-person introspection. This need for first-person reflection arises for many of Descartes' primary notions, not simply the *cogito*: "This is why I wrote 'Meditations' rather than 'Disputations.' ... In so doing I wanted to make it clear that I would have nothing to do with anyone who was not willing to join me in meditating and giving the subject attentive consideration" (AT VII 157, CSM II 112).

4. COLLECTIVE VERSUS PIECEMEAL DOUBT

Descartes' method requires us to subject *all* our former beliefs to doubt. However, "for the purpose of rejecting all my opinions," he writes, "I will not need to run through them all individually" (AT VII 18, CSM II 12). One problem with a piecemeal approach is *practical*: the "endless task" of considering one's beliefs individually is solved by a collective doubt aimed at their common basis: "Once the foundations of a building are undermined, anything built on them collapses of its own accord" (ibid.). Another problem is *logical*: propositions may misleadingly *seem* indubitable only because of their logical relations to other (perhaps false) propositions already believed. The solution, again, is a collective doubt – a point Descartes illustrates with a famous metaphor:

Suppose [someone] had a basket full of apples and, being worried that some of the apples were rotten, wanted to take out the rotten ones to prevent the rot spreading. How would he proceed? Would he not begin by tipping the whole lot out of the basket? And would not the next step be to cast his eye over each apple in turn, and pick up and put back in the basket only those he saw to be sound, leaving the others? (AT VII 481, CSM II 324)

The metaphor suggests a procedure for separating false beliefs from the opinions accumulated over a lifetime: "The best way they can accomplish this is to reject all their beliefs together in one go, as if they were all uncertain and false. They can then go over each belief in turn and re-adopt only those which they recognize to be true and indubitable" (ibid.).

5. THE DOUBTFUL MINDSET

Descartes' prescription – that we should *reject doubtful propositions* – requires not dissent but merely treating them *as if* false: "Anything which admits of the slightest doubt I will set aside just *as if* I had found it to be wholly false" (AT VII 24, CSM II 16; emphasis added). As Bernard Williams (1978, 36) notes, "To *reject* the doubtful here means, of course, to suspend judgement about it, or at most to treat it as false for the purposes of the argument, not to assert that it is false – something which, as Descartes pointed out ... would be no less dogmatic than one's usual state of mind, and considerably less reasonable."

We can understand the prescription as applying to all – but only – candidates for strict knowledge. Methodic doubt is not supposed to be extended to practical matters: "I made a very careful distinction between the conduct of life and the

contemplation of the truth” (AT VII 149, CSM II 106). Elsewhere, Descartes illustrates the point with someone who “decided to abstain from all food to the point of starvation, because he was not certain that it was not poisoned” – a scenario wherein the person “would be rightly regarded as insane” (AT III 422, CSMK 189). Similarly, Descartes does not extend methodic doubt to his own methodological assumptions. As he writes, “there may be reasons which are strong enough to compel us to doubt, even though these reasons are themselves doubtful, and hence are not to be retained later on” (AT VII 473, CSM II 319).

6. EVIL GENIUS DOUBT AND FIRST PRINCIPLES

Explaining the doubt resistance of first principles – for example, the *cogito* – Descartes writes:

For we cannot doubt them unless we think of them; but we cannot think of them without at the same time believing they are true, as was supposed. Hence we cannot doubt them without at the same time believing they are true; that is, we can never doubt them. (AT VII 145–46, CSM II 104)

Prima facie, these remarks imply that such principles are immune to doubt, allowing that even atheists could know them without first proving God is no deceiver. Other passages imply that no beliefs are immune to doubt – that *all* are vulnerable to the evil genius doubt, at least when applied to beliefs considered indirectly. Descartes explains this indirect doubt in an important Third Meditation passage. *While* directly attending to “something very simple and straightforward in arithmetic or geometry, for example that two and three added together make five,” we cannot but assent. (Elsewhere, Descartes adds that “the nature of my mind is such that I cannot but assent to these things, at least so long as I clearly perceive them” [AT VII 65, CSM II 45].) However, upon diverting our attention from these propositions, we can indirectly doubt them: “Indeed, the only reason for my *later* judgement that they were open to doubt was that it occurred to me that perhaps some God could have given me a nature such that I was deceived even in matters which seemed most evident” (AT VII 36, CSM II 25; emphasis added). Descartes concedes that the evil genius doubt is itself highly dubious – “any reason for doubt which depends simply on this supposition is a very slight and, so to speak, metaphysical one”; yet he treats it as a genuine doubt that prevents knowledge-worthy certainty: “But in order to remove even this slight reason for doubt, as soon as the opportunity arises I must examine whether there is a God, and, if there is, whether he can be a deceiver. For if I do not know this, it seems that I can never be quite certain about anything else” (AT VII 36, CSM II 25). Within Descartes scholarship, there is no consensus about the precise

scope of evil genius doubt – namely, about whether it extends to first principles. The broader issues include the so-called **Cartesian Circle**.

7. INTERNALITY, EXTERNALITY, AND EPISTEMIC PRIORITY

An ongoing legacy of Descartes' philosophy is the doctrine that introspective judgments rest on an epistemically more secure footing than judgments about the external world. As Descartes writes, "I can achieve an easier and more evident perception of my own mind than of anything else" (AT VII 34, CSM II 22–23). In his view, the privileged certainty of introspective judgments – for example, about occurrent **sensations** – arises "provided we take great care in our judgements concerning them to include no more than what is strictly contained in our perception – no more than that of which we have inner awareness" (AT VIIIA 32, CSM I 216). Reflection on the doubt resistance of such matters helps us "to realize that the knowledge of our mind is not simply prior to and more certain than the knowledge of our body, but also more evident":

For example, if I judge that the earth exists from the fact that I touch it or see it, this very fact undoubtedly gives even greater support for the judgement that my mind exists. For it may perhaps be the case that I judge that I am touching the earth even though the earth does not exist at all; but it cannot be that, when I make this judgement, my mind which is making the judgement does not exist. (AT VIIIA 8–9, CSM I 196)

Noteworthy is the role of doubt in helping clarify the doctrine. That Descartes waits until the final paragraph of the *Meditations* to rebut the dreaming doubt serves as an ongoing reminder about the epistemic priority of the internal over the external. By design, the entire constructive argument, up to that point, is sustained while remaining in doubt about whether we are awake. Epistemic progress is built up from the inside – from attention to our ideas.

Often overlooked in discussions of the doctrine is that *priority* does not entail *infallibility*. For Descartes, the standard of infallibility is not internality, but clarity and distinctness. We can, and do, make mistakes in judgments about our own ideas (see *Principles* I.66–68) (cf. Newman 2010).

On a popular interpretation, the doctrine is related to Descartes' embrace of an indirect theory of **perception**. Accordingly, in normal sensation the mind's perception of external objects is mediated by perception of its own ideas; importantly, ideas play this mediating role whether or not we notice it. Unavoidably, therefore, our minds must employ an inside-to-out procedure of inferring truths about the external world on the basis of inward appearances – a procedure explicitly used in

the *Meditations*. (For recent rejections of this interpretation, see Broughton 2002 and Carriero 2008. For a defense, see Newman 2009 and 2011.)

See also Circle, Cartesian; Certainty; Clarity and Distinctness; *Cogito Ergo Sum*; Error, Theodicies of; God; Idea; Knowledge; Method; Mind; Thought; Truth

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LEX NEWMAN

DREAMS, DESCARTES' THREE

Descartes' Three Dreams happened on the night of November 10, 1619, the culmination of days of fevered concern with the search for **truth**. In the First Dream,

Descartes is walking through the streets haunted by terrifying phantoms. A severe weakness in his right side forces him to bend over to his left. He tries to straighten up, but a whirlwind spins him three or four times on his left foot. More frightening is the thought that he is falling at every step he takes. Then he enters through the open gates of a college, seeking relief and intending to pray in the college chapel. But he has passed someone he knows without hailing him. He tries to turn back to greet him, but the wind hurls him against the chapel. At the same time he sees in the college courtyard another person who greets him and tells him that "Monsieur N." has something to give him. Descartes imagines it is a melon brought from a foreign country. The people standing around him are firm on their feet, whereas he is staggering about, even though the wind has abated. Then he awakes with a pain making him fear that an evil demon is leading him astray. He rolls over from being on his left side (where he had fallen asleep) and prays to God for protection from the dream's evil effects and from the misfortunes that might invite divine retribution for his sins, though others might have thought that hitherto he has led an upright life.

Falling asleep after a couple of hours thinking about the good and evil in the world, Descartes has the Second Dream. A piercing noise, he thinks a thunderclap, frightens him back to the waking state, and on opening his eyes he sees about him large numbers of fiery sparks. This is not the first time he has woken up to find his eyes emitting sparks by which he could see objects close by. Finding a satisfactory natural explanation of the strange phenomenon, he falls asleep again.

A moment later there is the peaceful Third Dream. Descartes finds a book on his table without knowing who put it there. It is a "Dictionary" (*Dictionnaire*, as in **Baillet**), and he expects to find it useful. In the same instant, his hand falls on another book entitled *Corpus poetarum*, again without knowing how it got there (*Corpus omnium veterum poetarum latinorum*, edited by P. des Brosses, in the edition of either Lyons 1603 or Geneva 1611, both of which Descartes could have known). On opening it, his eye falls on the lines "Quod vitae sectabor iter?" (What way of life will I follow?). At that moment, an unknown man shows him and praises another poem beginning "Est et Non." Descartes says the poem is from the *Idylls* of Ausonius, one of the poets in the anthology. (The two poems are *Edylia* XV and XVII.) Descartes begins to leaf through the *Corpus*, whose arrangement he knows well. The man asks him where he got the book. Descartes cannot say, but a moment before there was another book, the Dictionary, that has now vanished, without his knowing who brought it to him or who took it away. Before he finishes speaking, he sees reappearing at the other end of the table the Dictionary, but no longer entire, as it was the first time. He finds Ausonius in the *Corpus*, but cannot find "Est et Non," so he tells the man he knows a more beautiful poem beginning with the words "Quod vitae sectabor iter?" The man asks Descartes to find it for him, and Descartes, when searching, comes across small copperplate portrait engravings, which lead him to

remark that this is a fine volume, yet different from the one he knows. At this point the man and the books vanish, without Descartes waking up.

The source of this narrative is Baillet's translation of Descartes' lost Latin manuscript *Olympica* (see Baillet 1691). According to Baillet, Descartes before waking formed his own interpretation of the dreams, which he believed came "from on high." The First and Second Dreams were warnings about the misdeeds of his past life. The melon of the First Dream signified "the charms of solitude, but presented through purely human enticements." The thunderclap in the Second Dream was the Spirit of Truth taking possession of him. The Third Dream revealed concerns about Descartes' future way of life (Idyll XV), which the Spirit of Truth showed must be the pursuit of "all the sciences gathered together," symbolized by the Dictionary. Idyll XVII, the "Yes and No" of Pythagoras, signified Truth and Falsity, and the *Corpus poetarum* signified the unity of Wisdom and Philosophy. The words of the poet can be wiser and more profound than those of the philosopher.

It is not clear that a theory of dreams underlies these interpretations, or that they draw on available dream theories (Aristotelian, Macrobian, Neoplatonic, Hermetic, or Rosicrucian). A passage from the Latin manuscript copy "Cartesius" (in Leibniz's papers: AT XI 647–49) outlines a natural interpretation of "veridical" or "prophetic" dreams, in which images from **perception, memory**, or dreams all condition the parts of the brain to form associations between waking and dream experiences, so the same or similar images can be reidentified more easily. However, it is not certain that "Cartesius" is authentic Descartes, so it is not a dependable source.

In our day, the Dreams have engendered many ingenious speculations as to their meaning. None of them can be conclusive, given the immunity to confirmation enjoyed by all dream interpretations, yet some of them deserve mention. Maybe the melon in the First Dream symbolizes the visible universe, the Aristotelian spherical universe, the globe of the world, the science of the cosmos, the scientific ideas that occupied Descartes in 1619, the fruit of the forbidden knowledge of Genesis, sensual or sexual pleasure, the self as wholly other, friendship, or evil. Maybe the melon is a verbal pun on *melun*, the hometown of one of Descartes' *camarades* at La Flèche, or is homophonous with the Greek for "the future," "things to come" (anticipating Idyll XV of the Third Dream). In keeping with Descartes' own belief that the Dictionary symbolizes the sciences, perhaps he found on his table the two philosophical lexica (1613, 1615) of Rudolph Goclenius, bound in a single volume. On its first appearance in the dream, the Dictionary was complete, but not on its reappearance. Moreover, Descartes would have remembered that heading the same letter "Ad lectorem" in each lexicon is the same coupling into one supposed "epigram" of lines taken from two of the *Epigrammata* of Ausonius (included in the *Corpus poetarum*) (see Gabbey and Hall 1998).

See also Baillet, Adrien; Doubt; *Private Thoughts*

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ALAN GABBEY

DU HAMEL (OR DUHAMEL),
JEAN (?–1705)

The date and location of his birth unknown, Jean Du Hamel (not to be confused with Jean-Baptiste Du Hamel [1624–1706], the first secretary of the Académie des sciences) is connected to **Cartesianism** by his critical response to the Cartesian elements of **Pierre-Sylvain Régis's** *Système de philosophie* (1690; title changed in later editions to *Cours entier de philosophie*). In his *Réflexions critiques sur le système cartésien de Mr Régis* (1692), he attacks the Cartesian **method of doubt**, charges that the *cogito* argument begs the question, and argues against the Cartesian conception of the **objective being of ideas** (see AT VII 92–93, CSM II 66–67 for a similar complaint). Du Hamel also criticizes Régis in particular for his (nonstandard, from a Cartesian perspective) views that our ideas of **bodies** are sufficient to entail that bodies in fact exist and that matter, once created, cannot be destroyed, even by **God**. Régis responded to these attacks in his *Réponse aux Réflexions critique du M. Du Hamel* (1692). Du Hamel's reply to this response came several years later in his brief (sixteen-page) *Lettre de Monsieur Du Hamel, ancien professeur de philosophie de l'Université de Paris, pour servir de replique à Monsieur Régis* (1699). He was also the author of a Scholastic, and decidedly anti-Cartesian, course of **philosophy**, *Philosophia universalis* (1705). Du Hamel died in Paris in 1705.

See also Being, Formal versus Objective; *Cogito Ergo Sum*; Doubt; God; Régis, Pierre-Sylvain

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FRED ABLONDI

DUALISM

The term “Cartesian dualism” refers to Descartes’ claim that **mind** and **body** are “really distinct” **substances**. Following some brief remarks on the background to this claim, this entry examines Descartes’ arguments for the claim and its content (i.e., what exactly “mind” and “body” encompass for Descartes). Further related issues (mind-body interaction, the “substantial union” of mind and body) are treated elsewhere in this volume (see **human being**).

Descartes’ Aristotelian predecessors held that souls were the principle of life and hence that all living things had souls. Living things, and hence souls, formed a hierarchy: plants possessed “vegetative” souls, which performed the functions of nutrition and reproduction; nonhuman **animals** possessed “sensitive” souls further responsible for locomotion, **sensation**, and **imagination**; human beings alone possessed “rational” souls, which were responsible for thinking, judging, and willing (see, e.g., **Eustachius** 1609, pt. III.iii). Descartes’ dualism amounted to a radical overhaul of this tradition. On the one hand, in identifying the **essence** of body as **extension** and in insisting that everything corporeal was *mechanically* explicable, he brought life, and the other functions of the vegetative and sensitive souls, within the scope of mechanical **explanation**: the difference between life and death is analogous to that between a clock that is functioning properly and one that is broken (AT XI 330–31, CSM I 329–30). On the other hand, he eliminated the need for any soul other than the rational soul (AT XI 202, CSM I 108), which in his hands became the *mind*: an immaterial thinking substance; it alone was outside the scope of mechanical explanation (see Baker and Morris 1996, 69ff., and Rozemond 2006).

I. DESCARTES' ARGUMENT FOR MIND-BODY DUALISM

We focus here on Descartes' main argument for the claim that mind and body are distinct substances (AT VII 78, CSM II 54). Space precludes treatment of a second argument, grounded in the ideas that "the body is by its very nature always divisible, while the mind is utterly indivisible" (AT VII 85–86, CSM II 59) (see **divisibility**).

Descartes' argument cannot be fully understood without some prior grasp of his linked conceptions of substance, essence (or principal **attribute**), and (real) **distinction** (all of these terms were common currency among his Scholastic predecessors and contemporaries, although individual conceptions varied). His clearest explanations of these terms occur in the *Principles*. A substance is "a thing which exists in such a way as to depend on no other thing for its **existence**" (AT VIIIA 24, CSM I 210); to be precise, in the case of *finite* substances (as mind and body are argued to be), they are such as to require "only the ordinary concurrence of God in order to exist" (AT VIIIA 25, CSM I 210) (see **concurrence versus conservation, divine**).

Intuitively, substances contrast with properties: the latter depend on substances for their existence. There is, however, a vital distinction between essential properties, on the one hand, and **modes**, on the other. The essential attribute of a substance is an attribute "without which the substance is unintelligible" (AT VIIIA 30, CSM I 214). A substance and its essential attribute are "merely conceptually distinct" (AT VIIIA 31, CSM I 215). By contrast, modes depend on (or are "referred to") the essential property for their existence (AT VIIIA 25, CSM I 210).

Finally, Descartes distinguishes between three different types of **distinction** (AT VIIIA 28–31, CSM I 213–15): real, modal, and conceptual (or rational). The first is crucial for our purposes: "Strictly speaking, a *real* distinction exists only between two or more substances; and we can perceive that two substances are really distinct simply from the fact that we can clearly and distinctly understand one apart from the other" (AT VIIIA 28, CSM I 213).

There have been many attempts to reconstruct Descartes' main argument for the real distinction (see, e.g., Wilson 1978, 185ff.; Rozemond 1998, chs. 1 and 2). Here is one simple version. The key premises are (i) "I have a clear and distinct idea of myself, in so far as I am simply a thinking, non-extended thing" (i.e., a mind), and (ii) "I have a distinct idea of body, in so far as this is simply an extended, non-thinking thing." The conclusion he draws is that "it is certain that I [i.e., my soul or mind] am really distinct from my body" (AT VII 78, CSM II 54). (He adds, "and can exist without it," a clause mediated by the idea that "everything which I clearly and distinctly understand is capable of being created by God so as to correspond exactly with my understanding of it.") The word "thing" in both premises must be understood as "substance" (*res*); premise (i) is to be understood as implying that the sole essential attribute of the mind is thinking, premise (ii) as implying that the sole essential

attribute of body is extension. The terms “non-extended” and “non-thinking” are appended so as to make it manifest that the two substances “can clearly and distinctly be understood *apart* from one other,” as the **definition** of “real distinction” requires. With these clarifications, the argument appears valid.

Much critical discussion focuses on the justification for the premises. For instance, suppose we accept that Descartes has demonstrated in the Second Meditation that he exists and is a thinking thing. Why should this thinking thing not be a body and hence *also* an extended thing? (This question was raised by **Regius** in his famous “broadsheet” [AT VIIIB 343, CSM I 294–95].) This might seem to suggest that this thinking thing could have *two* principal attributes, namely, **thought** and extension; this is, however, ruled out by the fact that “each substance has *one* principal property which constitutes its nature and essence” (AT VIIIA 25, CSM I 210; emphasis added). It might still seem to leave it open that the principal attribute of this thinking thing was extension, which would entail that thought was a mode of *extension* (since, recall, every nonessential property is “referred to” this principal attribute). Strategies for defending Descartes against this include elaborating a Cartesian argument to the conclusion that thought is not a mode at all but a principal attribute (Rozemond 1998, 12ff.), and urging that thought (unlike, say, **shape**) cannot be clearly and distinctly understood as a mode of extension in length, breadth, and depth.

2. THE CONTENT OF DESCARTES’ DUALISM

It is clear that for Descartes the essence of mind is thought, the essence of body, extension. These claims, however, leave much scope for interpretation. *Sense perception* and *imagination* are focal points for controversies about Descartes’ conception of thought; *sensible qualities* are equally cruxes for understanding extension, for largely parallel reasons.

Consider Descartes’ claim that “a thing which thinks” is “a thing which **doubts**, understands, affirms, denies, is willing, is unwilling, and also imagines and has sensory perceptions” (AT VII 28, CSM II 19). This is often read as indicating that Descartes is simply *expanding* the scope of the ordinary term “thought” to cover mental images and sensations as well as articulate thoughts and **judgments**. An immediate objection is that this reading fails to take seriously the term “also” in this quotation. One way of doing so is to see it as signaling Descartes’ *hesitation* in classifying sense perception and imagination as modes of thinking and ultimately to indicate his commitment to what Cottingham (1986, 122–23, 127ff.) calls “trialism,” according to which sensation and imagination constitute a third principal attribute alongside thought and extension. Trialism is, however, incompatible with Descartes’ dualism: although Cottingham (1986, 131) interprets trialism attributively rather than substantively, any principal attribute must be the attribute of *a substance* within

Descartes' system; thus, attributive trialism *entails* substantive trialism. Other expansionists argue that "also" signals Descartes' break from the Aristotelian tradition in conceiving the mind as the subject of not just intellection but also imagination and sensory perception (Rozemond 1998, ch. 2); yet this still leaves it opaque as to why Descartes cleaves so firmly to the word "thought" (*cogitatio*). An alternative interpretation (Baker and Morris 1996) that appears to sidestep both objections argues that Descartes is here delineating a *narrow sense* of the terms "imagining" and "having sensory perceptions" (cf. AT III 361, CSMK 180), a sense in which these things clearly count *as thinking*: "What is called 'having a sensory perception' is *strictly* just this [seeming to see, to hear, and to be warmed – that is, on this interpretation, *thinking* that one is seeing, hearing, or being warmed], and in *this restricted sense* of the term it is simply thinking" (AT VII 29, CSM II 19; emphasis added). Sense perception and imagination are "faculties for *special* modes of thinking" because they are not essential to minds ("I can clearly and distinctly understand myself as a whole without these faculties" [AT VII 78; CSM II 54]); they are only possessed by minds united to bodies (see **sensation** for further discussion).

What about the essence of body, namely, "extension in length, breadth and depth" (AT VIIIA 25, CSM I 210)? Descartes claims that the bodies, which are the source of our perception of sensible qualities – for example, "colours, sounds, smells, and tastes, as well as differences in heat, hardness and the like" – "possess differences corresponding to them, though perhaps not resembling them" (AT VII 81, CSM II 56; cf. AT VIIIA 34, CSM I 218). As with Locke's well-known treatment of sensible or "secondary" qualities, it is sometimes claimed that Descartes is *denying* that corporeal things are colored and scented. His claim is more nuanced: he argues that our *ideas* of colors and smells are confused ideas (e.g., AT VII 43, CSM II 30); we can, however, untangle from this confused idea a distinct idea of what it *is* for corporeal things to be colored and scented: "The properties to which we apply the terms light, colour, smell, taste, sound, heat and cold" are "simply various dispositions in those objects which make them able to set up various kinds of motions in our nerves" (AT VIIIA 322–23, CSM I 285). Again, "something's being tasteless consists not in its lacking the sensation of taste within itself, but in lacking the power to cause such a sensation" (AT II 44, CSMK 102). Thus, in this *strict* sense, sensible qualities are modes of extension, just as exercises of the **faculty** of sense perception are modes of thinking; but just as sense perception is a *special* mode of thinking, sensible qualities are *special* modes of extension. They are inessential to body: color "and all other such qualities that are perceived by the senses as being in corporeal matter, can be removed from it ... it thus follows that its nature does not depend on any of these qualities" (AT VIIIA 42, CSM I 224), and their existence as sensible qualities depends in some way on the existence of sensitive creatures.

Descartes' revolutionary view had two important consequences. First, he was able to offer a more intelligible account of the possibility that the soul could survive

the death of the body and hence “give mortals the hope of an after-life” (AT VII 13, CSM II 10) (see **soul, immortality of the**). Second, he hoped – in the context of **Galileo’s** condemnation – to leave science to pursue its mechanical explanations of the natural world free from interference from the church, whose proper bailiwick was man’s soul.

See also Attribute, Distinction (Real, Modal, and Rational), Essence, Extension, Mode, Sensation, Substance, Thought

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KATHERINE MORRIS

EARTH, MOTION OF THE

Descartes was an early advocate of many aspects of Copernican astronomy, in particular, the heliocentric premise that the earth orbits the sun, but the details of his particular version of Copernicanism have long baffled philosophers and scientists, and the whole affair is symptomatic of the complex relationship that existed between science and religion in the seventeenth century.

The Ptolemaic system, with its geocentric hypothesis that the earth is at rest at the center of the universe, was the theory accepted by the church during Copernicus's life (1473–1543), although by Descartes' day most natural philosophers had turned to Copernicus's own system or the less radical Tychonic system, the latter upholding geocentrism (earth-centered universe). In his early, unpublished treatise on natural philosophy, *The World* (1633), Descartes advanced the Copernican idea that the earth moves around the sun, along with all of the other planets in the solar system (AT XI 64, G 41). But the news that **Galileo** had violated church censorship by embracing Copernicanism led Descartes to withdraw the work from publication. Writing to **Mersenne** in the fall of 1633, he comments that he was astonished to hear of Galileo's censure and adds "that if the view [that the earth moves] is false, so too are the entire foundations of my **philosophy**" (AT I 271, CSMK 41).

In 1644 Descartes published his *Principles of Philosophy*, which generally follows the outline of his theory of planetary motions accepted in *The World*, although it contains a more elaborate, Scholastic-influenced account of **motion** that would have ramifications for attributing rest and motion to bodies, including planets. In short, while motion can be taken in the ordinary sense as a mere change of place, Descartes' proper **definition** of motion is the transference of a **body** from the neighborhood of contiguous bodies that surround it that are taken to be at rest, with rest being the absence of such a transference (AT VIIIA 53–54, CSM I 233). The *Principles* also accepts, as did the *World*, a matter-filled world (or **plenum**) that is absent of any void spaces, as well as his vortex theory of planetary motion. The **vortex** theory holds that the planets are situated in large bands of particles that circle around the sun, with each planet enclosed in a different band moving at different speeds. Given the conjunction of his new account of motion and the vortex theory, Descartes is led to the following conclusion: "From this it follows that no movement, in the strict sense, is found in the earth or even in the other Planets; because they are not transported from the vicinity of the parts of the heaven immediately contiguous to them, inasmuch as we consider these parts of the heaven to be at rest. For, to be thus transported, they would have to be simultaneously separated from all the contiguous parts of the heaven, which does not happen" (AT VIIIA 90, MM 94–95). Therefore, since the earth remains at rest relative to the particles that surround it in its vortex, it does not move in the strict philosophical sense. Yet, Descartes begrudgingly admits that one can still accept a motion of the earth in the ordinary sense of

motion: “However, if, in spite of this, conforming to common usage, we seem further on to attribute some motion to the earth, it will have to be remembered that we are speaking improperly, in the way in which it is sometimes possible to say, of passengers who lie sleeping in a ship, that they nevertheless go from Calais to Dover, because the vessel takes them there” (AT VIII A 92, MM 96).

In the *Principles*, after quickly dispatching the Ptolemaic system for being inconsistent with observational evidence (AT VIII A 85), Descartes goes on to argue against the Copernican and Tychonic theories on the grounds that they cannot account for the earth’s being at rest in his strict sense of the term. He begins by simply noting that “Copernicus had not hesitated to attribute motion to the earth” (AT VIII A 85, MM 90) and then turns his attention to the Tychonic system, named after the Danish astronomer, Tycho Brahe (1546–1601). Brahe had postulated that all of the planets, save the earth, orbit the sun, but that this entire ensemble in turn orbits the stationary earth. Descartes, however, invokes various criteria in arguing that his strict definition of rest is not met by the Tychonic system: namely, that since the process of motion is reciprocal (i.e., that the motion can be attributed to either of a pair of bodies given an observed motion), it is nevertheless possible to correctly assign the motion to the body that undergoes a complete change of its contiguous neighbors (as opposed to one that undergoes a change of only some of its neighbors) (AT VIII A 56–57). So, given the daily revolution of the heavens around the earth, it follows that “all parts of the earth are transferred from all the parts of the heaven which they were touching a short while before” and “because this transference is reciprocal ... and because there must be as much force or action in the earth as in the heaven; this transference gives us no reason to attribute motion to the heaven rather than to the earth” (AT VIII A 96; MM 101).

Descartes’ defense of a motionless earth has incited numerous objections from many philosophers and scientists from the seventeenth century up to the present day. Many of the allegations center upon the problems that his account of motion in the *Principles* engenders for his overall **physics** and astronomy – for instance, the troublesome and counterintuitive inference that the passengers on his Dover-bound ship are not moving in the strict sense. On the other hand, some have charged that his new doctrine of motion, and the subsequent defense of a stationary earth, was not his actual view, but rather a concession to the church to avoid censorship of his natural philosophy.

See also Body; Galilei, Galileo; Motion; Physics; Plenum; Vortex

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EDWARD SLOWIK

ELEMENT

In the autumn of 1631, Descartes comments favorably on the content of a *Memoir* by **Étienne de Villebressieu**, which states that “the nature of these elements ... which are called earth, water, air and fire consists only in the difference between the fragments, or small and large particles” of one and the same type of matter (AT I 216, CSMK 33). When he writes to Villebressieu, Descartes had already drafted chapter 5 of *The World*, which explains that three elements form “all the **bodies** of which the universe is composed.” The first one, which “may be called the element of fire,” consists of extremely fast and small particles that constitute the matter of the sun and of the fixed stars. Owing to their extreme subtlety and to their capacity to “change shape at every moment to accommodate themselves to the **shape** of the **places** they enter,” these particles are also able to fill the gaps among the particles of the other two elements. The second element, “which may be called air,” is made of “more or less round particles” of different size which constitute celestial vortices (see **vortex**); the third element, “namely that of earth,” which makes up the earth, the planets, and the comets, is composed of comparatively large parts “which have very little or no **motion** that might cause them to change position with respect to one another” (AT X 23–31, G 16–21). There is no qualitative difference between the elements: the two pairs of contraries (hot and cold, moist and dry), which characterize the four Aristotelian elements, are “themselves in need of **explanation**,” being like all other qualities the result of the “motion, size, shape and arrangement” of the particles of matter (AT X 26, G 18). In the *Principles of Philosophy* (1644), Descartes reiterates his conviction that only one type of matter exists and that “all the properties which we clearly perceive in it are reducible to its **divisibility** and consequent mobility in respect of its parts” (AT VIIIA 52–53, CSM I 232), but he does not associate his own elements with air, fire, and earth anymore.

Both in *The World* and in the *Principles*, Descartes offers a hypothetical reconstruction of the emergence of the three elements out of an undifferentiated first matter. However, while in chapter 6 of *The World* he imagines these elements to have originated simultaneously from one big block of solid matter, which **God** divided into many parts “some larger some smaller, some of one shape some of another” by imparting different motions to them (AT X 34, G 23), in the *Principles*

he supposes that matter was originally divided into equal, cubic particles, the size of which was intermediate between those of the third and of the second element. Having been set in motion “individually and separately around their own centres,” these particles took up the form of the round particles of the second element, their angles being worn down during the collisions. Given that no **vacuum** can exist in nature, the spaces between these round particles were filled in by a more **subtle matter** (first element) formed by the debris of the original cubic particles (AT VIIIA 101–4, CSM I 257–58). The third element arose at a later stage, as the result of the conglomeration of the particles of the first element (AT VIII A 147–48, MM 136).

See also Body, Extension, Plenum, Shape, Subtle Matter, Vacuum, Vortex

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CARLA RITA PALMERINO

ELISABETH, PRINCESS OF BOHEMIA (1618–1680)

Princess Elisabeth (Elisabeth Simmern van Pallandt) was born in Heidelberg to Fredrick V, elector of Palatine, and Elizabeth Stuart. Fredrick would become the “Winter King” of Bohemia, and after his short reign in 1620, the family lived exiled in The Hague. After Fredrick's death in 1632 while fighting on behalf of King Gustave of Sweden in the Thirty Years' War, the family fell into financial difficulties. We know very little about Elisabeth's education, but we do know that she studied languages – Latin, Greek, French, English, and German – along with **mathematics** and natural philosophy. Elisabeth never married, although she received a proposal from King Wladislav of Poland in 1633. The king was a Catholic, and Elisabeth refused to convert from her Protestant faith in order to facilitate the marriage. In

1660 Elisabeth entered the Lutheran Convent at Herford, and she became abbess in 1667. As abbess she sheltered various religious persons who faced persecution, such as Labadists, including Anna Maria van Schurman, and Quakers. Elisabeth had long suffered from illness and died in 1680. It is reported that Francis Mercury van Helmont and **Leibniz** were present at her death.

Elisabeth's only extant philosophical work is the **correspondence** with Descartes. She insisted that the correspondence be kept private, although Descartes did circulate some of it during his lifetime (most notably to **Queen Christina of Sweden**). Although Descartes' part of the correspondence was published soon after his death, Elisabeth's letters were not published until 1879. Elisabeth had a reputation for intelligence and philosophical and mathematical acumen that was unusual for a woman at the time. It is clear from her correspondence that she was known at the university of Leiden and may have studied there. In addition to her correspondence with Descartes, it is believed that she had contact with **Henry More** and **Nicolas Malebranche**, as well as Gassendists such as Samuel Sorbière.

The correspondence with Descartes covers a wide range of issues: mind-body interaction, the **passions**, **free will** and **God's** providence, the sovereign good, political rule, mathematics, and **medicine**. However, the correspondence is best known for the discussion of the mind-body problem. Elisabeth presses Descartes to give an account of how an immaterial **mind** can move a material **body**. Like Descartes, Elisabeth subscribes to the mechanical view of matter, according to which body is moved by impulsion or by the quality or **shape** of bodies. Given this view, she claims, it is difficult to see how mind could move body unless mind has some properties in common with body. Elisabeth seems to hold that mind must be extended in order to move the body, and she argues that since she does not clearly and distinctly perceive **extension** to be incompatible with the **essence** of mind, it is possible that it is so (see **human being**).

The discussion of the passions is also an important part of the correspondence and inspired Descartes to write the *Passions of the Soul*. Their correspondence concerning the passions begins as a discussion of Seneca's *De vita beata*. Descartes claims that the passions, although they might be useful in some cases, are to be regulated by **reason** in order to ensure **happiness** and contentment. Elisabeth objects that sometimes misfortunes arise that make it impossible to control one's passions and argues that this shows that happiness and contentment often depend on things outside one's control. This leads to a discussion of the sovereign good, which Descartes takes to be **virtue**. He defines virtue as follows: "a firm and constant will to execute all that we judge to be the best and to employ all the force of our understanding to judge well" (AT IV 277, CSMK 262). Elisabeth questions our ability to judge what is best, and wonders if our **judgments** are based on natural sentiments. To this, Descartes tells her that in order to judge well, we need **knowledge** of only three things: (1) God

exists, (2) the mind is immortal, and (3) the vastness of the universe shows we are part of larger things. Elisabeth responds by showing that knowing these three things can equally cause wrong judgments. She argues that knowledge of God does not console us from the evils caused by other free agents, the knowledge of the immortality of the soul might make us seek death, and that knowledge of the great extent of the universe might detach us from God rather than bring us closer (see **soul, immortality of the**).

The discussion of God's providence and free will shows Descartes trying to satisfy Elisabeth's worries that our freedom of will, which she takes as the ability to do otherwise that is evinced by our subjective feeling of freedom, is consistent with God's plan for the universe. Elisabeth presses Descartes to explain how God can be the total cause of a free action and to better explain his compatibilist account.

See also Free Will; Happiness; Human Being; Medicine; Passion; *Passions of the Soul*; Soul, Immortality of the; Virtue

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ENUMERATION

The concept of enumeration is introduced by Descartes within the context of his discussions on **method**, playing central roles in both the analysis and synthesis of **ideas**. The earliest and clearest discussion of the concept is found in the unpublished *Rules for the Direction of the Mind* (1628). The concept is also mentioned in his first published work, *Discourse on Method* (1637). A close examination of the concept of enumeration shows that it also plays an important role in his accounts of **clarity and distinctness**, which are important concepts in Cartesian epistemology.

Commentators have traditionally understood enumeration in its standard sense, namely, as the numbering or listing of items (Curley 1986). This may explain why the significance of the concept in Cartesian philosophy has been overlooked. When seen in connection with Descartes' employment of common natures, the enumeration appears to be akin to a logical partition (Smith 2001, 2010). The elements of ideas are what Descartes calls in the *Rules* the "**simple natures**" (Marion 1999). So, an enumeration of ideas might be best understood as a partition of the simple natures.

We produce an enumeration of objects whenever we place each object of inquiry into exactly one class, where the union of the classes produced is the original set of objects with which we began. For example, suppose that we wish to produce an enumeration of a bunch of marbles on a table. We will produce an enumeration of the marbles if, and only if, we place each marble in exactly one jar (a jar in this case

will be analogue to a class), where the union of (the contents of) the jars will be the original bunch of marbles on the table.

The sorting is accomplished by applying a specific kind of relation: an *equivalence relation*. Such relations are reflexive, symmetric, and transitive. For example, *x is the same color as y* is an equivalence relation. If those marbles on the table are monochromatic, applying this equivalence relation to the marbles will sort them – marbles of the same color will be placed in the same jar. So, if “A is the same color as B” is true, then marbles A and B are placed in the same jar. Given the colors are primary colors, ideally there would be a jar filled with red marbles, a second filled with blue marbles, and a third with yellow marbles. Each jar is (or is analogue to) an equivalence class. Each marble will be in exactly one jar, and the union of the jars will produce the original bunch of marbles on the table. Thus, applying the equivalence relation *x is the same color as y* produces an enumeration (or partition) of the objects under investigation (the marbles).

When two items being compared are similar, Descartes says that they share a common nature (AT X 439–40, CSM I 57). Common natures enable one to partition items because they possess certain properties, which in this context are expressed by certain **common notions**. As Descartes describes them, these common notions express properties that are similar to reflexivity, symmetry, and transitivity (AT X 419, CSM I 45). In possessing such properties, common natures look to be ancestors to what were called equivalence relations. In Cartesian terms, then, applying common natures in an examination of objects will produce an enumeration of those objects.

Descartes says that ultimately the enumeration should be a specific ordering of the **simple natures**, where this ordering is logico-epistemological in scope (AT X 381, CSM I 21). The simple natures are to be organized first into groups (i.e., classes), the hierarchical order of the classes expressing epistemic priority – where A is epistemically prior to B (so, A is higher in the hierarchy than B) whenever knowing B requires our knowing A. For example, knowing *shape* requires our knowing *extension*. Thus, in the enumeration the class of extended things would be higher in the hierarchy than the classes of shaped things (AT X 381, CSM I 21–22). As just explained, the procedure for organizing the simple natures into classes is by way of comparing them for similarity, placing those which share the same nature in a class. Doing so produces a hierarchical conceptual structure.

The hierarchical feature can be explained as follows. Let's return to the example of the marbles. Sorting marbles A, B, C, and so on, and using Descartes' terminology, the common nature expressed by *x is the same color as y* will produce the following enumeration of the marbles (into the three mutually exclusive classes of Blue, Red, and Yellow). The three mutually exclusive classes – Blue, Red, and Yellow – are what we might call *horizontally* distinct. They are horizontally distinct insofar as

they are located at the same level of the structure. So, blue marbles are horizontally distinct from red marbles. What is more, these classes are *vertically* distinct from the class Color. This class is “higher” in the hierarchy insofar as it *contains* the three mutually exclusive classes. Descartes calls this vertical relation “necessary conjunction” (AT X 42 I, CSM I 45–46). Given that class X is necessarily conjoined with class Y, which means that class X is contained in class Y, Descartes is able to ground systematic universal claims of the form “All X’s are Y’s.” So, an application of a common nature (equivalence relation) will produce an enumeration (partition) that will be part of a larger, hierarchical conceptual structure. This structure is what Descartes calls a “science” (*scientia*).

The import of enumeration to Cartesian philosophy is the following. Descartes begins his philosophical investigation by considering the finite **substances** of the cosmos. Let’s call this class of objects S. He applies the common nature *x has the same principal attribute as y*, which produces a new class (an enumeration), which we will call P, whose subclasses are the class of thinking things (T) and the class of extended things (E). Since every member of S is in exactly one member of P (i.e., each member of S is a member of either T or E but not both), and the union of the members of P is S, P is an enumeration of S. For Cartesian philosophy, we might call this the *master enumeration*. There are other attributes, for example, **duration** and **existence** (AT VIIIA 26, CSM I 211–12). But an application of them to the members of S does not result in the master enumeration. In establishing a relation that “unites” the elements of an idea into a single class, we make the idea *clear*. And, in establishing mutually exclusive classes, we make the idea distinct (Smith 2001, 2010). Therefore, if in applying a common nature to an idea the result is an enumeration, we make the idea (or its content) clear and distinct.

See also Clarity and Distinctness, Common Notion, *Discourse on Method*, Idea, Knowledge, Method, *Rules for the Direction of the Mind*, Simple Nature

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ERROR, THEODICIES OF

Descartes purports to prove the **existence** of an all-perfect creator. The most prominent philosophical reply to such “proofs” is the *problem of evil*. In turn, theists counter with *theodicies* – efforts at showing that **God** and evil are compatible. Securing a successful theodicy is essential to the *Meditations*, because Descartes makes divine benevolence the cornerstone of his epistemology. Indeed, the *Meditations* develops two theodicies. Philosophers generally distinguish *moral* evil (i.e., evil arising from voluntary human choices) and *natural* evil (i.e., evil arising from natural causes). Descartes’ Fourth Meditation theodicy addresses a form of moral evil arising from **judgment** error. His Sixth Meditation theodicy addresses a form of natural evil arising from sensory error.

The Fourth Meditation theodicy arises in the context of an inquiry into the nature and causes of judgment error. The traditional problem of evil derives from the fact of suffering in conjunction with the theistic supposition of a creator who is both all-powerful and all-good. Stating the problem in a form tracing to Epicurus, Hume (2007, 74) writes (of the creator): “Is he willing to prevent evil, but not able? Then is he impotent. Is he able, but not willing? Then is he malevolent. Is he both able and willing? Whence then is evil?” Descartes first introduces the problem in the First Meditation, in the course of his program of methodic **doubt**. With the external world in doubt, and thereby all external suffering (see **body, proof of the existence of**), Descartes frames the problem in terms of judgment error stemming from the possibility of an “omnipotent God” who is a deceiver – for example, allowing me to “go wrong every time I add two and three.” A passing effort at rebutting the doubt is made, on the grounds that “perhaps God would not have allowed me to be deceived in this way, since he is said to be supremely good.” Yet the supposition of a God who is both omnipotent *and* supremely good seems incompatible with error: “If it were inconsistent with [God’s] goodness to have created me such that I am deceived all the time, it would seem equally foreign to his goodness to allow me to be deceived even occasionally; yet this last assertion cannot be made” (AT VII 21, CSM II 14). This First Meditation treatment prefigures the Fourth Meditation account, itself coming on the heels of the Third Meditation argument *for* an all-powerful and all-good creator.

The Fourth Meditation account begins by restating the challenge. Assuredly, an all-perfect God “does not wish to deceive me,” yet this “appears to imply that I am incapable of ever going wrong” (AT VII 54, CSM II 38). The discussion of theodicy that follows centers around three main philosophical elements: a distinction between two notions of imperfection, a version of the **free will** defense, and a version of a greater goods defense.

How perfect must God’s creatures be? According to one answer, if the creator is all-perfect, then we should expect the same of its creatures. Descartes’ own answer

assumes the conceptual impossibility of creating an absolutely perfect kind of being. Because ontological dependence on a creator is, itself, an imperfection, only imperfect kinds *could* be creatures. This is not to say that all imperfections are equal, or that an all-perfect creator is compatible with all manner of imperfection. The details matter. In sorting out which cases are compatible with God, Descartes distinguishes two sorts of imperfection: imperfection at the level of *kinds* (relative to other possible kinds), and imperfection at the level of *instances* within a kind (relative to other possible instances). For example, automobile models lacking anti-lock brakes form a less perfect kind than those which have them (*ceteris paribus*); even so, a particular automobile might constitute a perfect instance of the non-anti-lock kind. Drawing on a Scholastic distinction, Descartes counts imperfection as *purely negative* insofar as it involves a mere lacking of features had by a more perfect kind. By contrast, *privative* imperfection – what Descartes sometimes calls *positive* imperfection – occurs when what the thing lacks prevents its proper functioning. Privation is therefore associated with deprivation and malfunction. Given this distinction, a satisfying theodicy for judgment error should address two possible concerns. First, it should establish that our **faculty** of judgment is not an imperfect instance of its kind – that it does not suffer privation: “It seems impossible that [God] should have placed in me a faculty which is not perfect of its kind, or which lacks some perfection which it ought to have” (AT VII 55, CSM II 38). Second, it should address the concern that our faculty, though nonprivative, constitutes a too imperfect *kind* – that is, a kind that is unworthy of creation.

How does Descartes argue that our judgment faculty is nonprivative? On his analysis, judgment involves two subfaculties – the **intellect** and the will. Summarizing the argument, Descartes concludes that the intellect, though finite, contains no privation. The intellect’s role in judgment is “to enable me to perceive the **ideas** which are subjects for possible judgements,” and it plays this role without error. Granted, there are many ideas that we lack, yet “it should not, strictly speaking, be said that I am deprived of these ideas, but merely that I lack them, in a negative sense” (AT VII 56, CSM II 39). Neither does the will suffer privation. Its role in judgment is “to affirm or deny” the contents perceived by the intellect. In this regard, the will’s perfection is “so great that the idea of any greater faculty is beyond my grasp” (CSM II 40, AT VII 57). Since neither the intellect nor the will suffers privation, what is the source of judgment error? Error results not from malfunctioning faculties but from our *misuse* of those faculties. In the context of metaphysical inquiry – and on a conception of **knowledge** as requiring infallibility – Descartes contends that the proper use of our faculties entails suspending judgment unless our **perception** is clear and distinct: if I “refrain from making a judgement in cases where I do not perceive the **truth** with sufficient clarity and distinctness, then it is clear that I am behaving correctly and avoiding error” (AT VII 59, CSM II 41). Though this rule is not easy to follow, Descartes

thinks he has shown that our faculties are nonprivative; for he has shown that they function properly, with proper use.

The theodicy incorporates elements of a free will defense because we have the ability to avoid error via our free will. Misuse of free will is indeed the locus of the privation associated with such error:

In this incorrect use of free will may be found the privation which constitutes the essence of error. The privation, I say, lies in the operation of the will in so far as it proceeds from me, but not in the faculty of will which I received from God, nor even in its operation, in so far as it depends on him. (AT VII 60, CSM II 41)

Actual judgment error – as opposed to its mere possibility – is a creature of *our* wills, not God's.

The argument, up to this point, is supposed to show that our faculty of judgment is a perfect instance of its kind, albeit an imperfect kind. It remains to be argued that it is not *so* imperfect a kind as to be unworthy of creation. (This aspect of the theodicy is by no means superfluous. By Descartes' own reckoning, our kind of judgment faculty is so imperfect that nobody in prior history had discovered a method of avoiding error – short of suspending judgment altogether.)

On this count, Descartes concedes part of the following objection. An all-perfect God could have, and thus would have, created us with a more perfect kind of faculty – one that is less prone to error. With respect to the *could have* part, Descartes allows that “God could easily have brought it about that without losing my freedom, and despite the limitations in my knowledge, I should nonetheless never make a mistake” (AT VII 61, CSM II 42). With respect to the *would have* part, Descartes thinks the objection falls short:

Had God made me this way, then I can easily understand that, considered as a totality, I would have been more perfect than I am now. But I cannot therefore deny that there may in some way be more perfection in the universe as a whole because some of its parts are not immune from error. (AT VII 61, CSM II 43)

This is a greater goods defense. From the fact that an omnipotent God could have made us more perfect, it does not follow that a supremely good God would have. (I have argued elsewhere [1999] that in the face of *probabilistic* versions of the problem of evil, the kind of theodicy Descartes here offers – a “defense,” in Plantinga's taxonomy [1974, 28] – does not meet the burden of proof. Yet in the context of the *Meditations*, wherein a *demonstrative* proof of an all-perfect God has been offered,

only the *logical* version of the problem carries weight. In that context, a successful defense meets the burden.)

This Fourth Meditation theodicy confronts only moral evil but not natural evil. At this juncture of the *Meditations*, the existence of the external material world remains in doubt. Descartes confronts natural evil in the Sixth Meditation, only after establishing an external material world.

In part, the Sixth Meditation theodicy marks a return to unfinished business. An implication of the earlier theodicy is that sense perception is unfit as a basis for reliable judgments about the external world. This raises a question concerning the purpose for which God gave us our sensory faculties. The answer comes in the Sixth Meditation:

For the proper purpose of the sensory perceptions given me by nature is simply to inform the mind of what is beneficial or harmful for the composite of which the mind is a part; and to this extent they are sufficiently clear and distinct. But I misuse them by treating them as reliable touchstones for immediate judgements about the essential nature of the bodies located outside us; yet this is an area where they provide only very obscure information. (AT VII 83, CSM II 57–58)

On this understanding, our senses are intended for practical purposes, not for metaphysical inquiry. A problem nonetheless arises, because our sensory faculties sometimes mislead us in practical contexts. Descartes discusses three examples of the class of sensory errors of interest: the case of being tricked into eating something that is pleasant tasting, yet poisonous; the case of dropsy, wherein quenching one's thirst for water causes one harm; and the phantom limb phenomenon, whereby amputees experience **sensations** as if *in* missing limbs. Call all of these "dropsy" cases. Dropsy cases pose special challenges compared with sensory illusion. Descartes is content to blame the individual where deception derives from a "habit of making ill-considered judgements" based on the confused perception of the senses (AT VII 82, CSM II 56). In dropsy cases, the deception seems more clearly to derive from the design of our faculties. As Martial Gueroult (1985, 137) explains, "recourse to the freedom of my judgment and to its ill use can no longer solve the problem. We must now discover a new approach in order to vindicate God and to validate the senses in spite of everything." Descartes writes:

I have already looked in sufficient detail at how, notwithstanding the goodness of God, it may happen that my judgements are false. But a further problem now comes to mind regarding those very things which nature presents to me as objects which I should seek out or avoid, and also regarding the internal

sensations, where I seem to have detected errors – e.g. when someone is tricked by the pleasant taste of some food into eating the poison concealed inside it. (AT VII 83, CSM II 58)

John Carriero (2009, 412, 419) argues that the special problems arise from “*incorrect* as opposed to *incomplete* information”; and he adds that “the reason that dropsy, I think, differs from arteriosclerosis is that dropsy ... involves *misinformation*.” The special problems call for a further theodicy.

The Sixth Meditation theodicy is not framed in the express terms of privation, unlike the Fourth Meditation effort. However, it is characteristic of the *Meditations* that the steps occurring later build on those occurring earlier. We may therefore incorporate the conceptual machinery of the earlier theodicy into our understanding of the later account. Thus interpreted, the theodicy rests on a twofold result: first, that dropsy cases do not derive from privative imperfection in our sensory faculties; second, that our sensory faculties do not constitute so imperfect a kind as to be unworthy of creation.

To determine whether our sensory faculties suffer privation, we must inquire into their intended function. Descartes thinks we are apt to confound *our* conception of a thing’s purpose with the true **nature** of things, a distinction he explains by analogy:

Admittedly, when I consider the purpose of the clock, I may say that it is departing from its nature when it does not tell the right time; and similarly when I consider the mechanism of the human **body**, I may think that, in relation to the movements which normally occur in it, it too is deviating from its nature if the throat is dry at a time when drinking is not beneficial to its continued health. But I am well aware that “nature” as I have just used it has a very different significance from “nature” in the other sense. As I have just used it, “nature” is simply a label which depends on my thought; it is quite extraneous to the things to which it is applied, and depends simply on my comparison between the idea of a sick man and a badly-made clock, and the idea of a healthy man and a well-made clock. But by “nature” in the other sense I understand something which is really to be found in the things themselves; in this sense, therefore, the term contains something of the truth. (AT VII 85, CSM II 58–59)

From our point of view, the occurrence of *any* error from dropsy cases can seem like *proof* of a privative “disordered nature.” However, Descartes thinks this is to use *nature* “as an extraneous label” (see **extrinsic denomination**); upon further reflection, we come to appreciate that – in the true nature of things – dropsy

cases are a necessary component of a greater good. Given the intrinsic nature of the mind-body union, the best *possible* system is bound to mislead us, on some occasions.

Why is it bound to mislead us? In answering this, Descartes explains the phantom limb phenomenon, itself inevitable given (among other things) the essential **divisibility** of corporeal nature. Part of his argument is that the brain functions as the bodily locus of mind-body interaction: the body's sensory inputs all send their neural signals to the brain; in turn, processes in the brain occasion conscious sensations in the **mind**. The possibility for error arises, because "every time this part of the brain is in a given state, it presents the same signals to the mind, even though the other parts of the body may be in a different condition at the time" (AT VII 86, CSM II 59–60). So, for example, if the lower leg has been amputated, it is possible to stimulate the nerve endings in the knee in a manner replicating the signals that would normally be sent from the lower leg – "the same motion will occur in the brain as occurs when the foot is hurt, and so it will necessarily come about that the mind feels the same sensation of pain" (AT VII 87, CSM II 60). One way to avoid this susceptibility to error would involve a system of ongoing miracles. But insofar as the better system involves discoverable regularities, Descartes contends that the susceptibility cannot be overcome. "It is quite clear from all this that, notwithstanding the immense goodness of God, the nature of man as a combination of mind and body is such that it is bound to mislead him from time to time" (AT VII 88, CSM II 61).

On the account that emerges, our susceptibility to error is not the result of an avoidable design flaw – as if the effect of an unimaginative designer. Rather, it is an inherent part of the best possible system – that is, one serving best to preserve the mind-body union:

The best system that could be devised is that it should produce the one sensation which, of all possible sensations, is most especially and most frequently conducive to the preservation of the healthy man. And experience shows that the sensations which nature has given us are all of this kind. (AT VII 87, CSM II 60f)

The remaining question concerns whether a system of this kind is good enough to have been created. Descartes thinks *yes*. He thinks that "in matters regarding the well-being of the body, [the] senses report the truth much more frequently than not" (AT VII 89, CSM II 61). And in all cases, God has equipped us with mitigating resources. The newfound understanding of dropsy cases, writes Descartes, is "the greatest help to me, not only for noticing all the errors to which my nature is liable, but also for enabling me to correct or avoid them without difficulty" (AT VII

89, CSM II 61). As Amy Schmitter (2008, 433) explains, the design of our systems enables a significant degree of correction:

The Sixth Meditation presents several of the self-diagnostic resources at our disposal: the interaction of our sense modalities, our memory, and above all, our **intellect**.... This is analogous to the use of our intellect in correcting our theoretical judgments. Although we are always capable of careless judgment, we also have the ability to learn about our faculties, and to train ourselves to use them properly. Similarly, we have the ability to learn about our dispositions for body-based perceptions, particularly about the mechanical operation of the bodily systems underpinning their function.

In the final analysis, Descartes thinks the inquiry goes beyond what is needed. It not only establishes the compatibility of God's nature with dropsy cases but magnifies the creator. Concerning the "sensations which nature has given us," he concludes that "there is absolutely nothing to be found in them that does not bear witness to the power and goodness of God" (AT VII 87, CSM II 60–61).

See also Doubt, Extrinsic Denomination, Faculty, Free Will, God, Human Being, Intellect, Judgment, Method, Mind, Sensation

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ESSENCE

It is well known that Descartes replaced the Aristotelian essence/property (*proprium*)/accident distinction with that between principal **attributes** and **modes** (cf. AT VIIIa 25–26, CSM I 210–12). Among the questions this raises are (1) whether the change is more than terminological; (2) how essence differs from **existence** (i) in general, (ii) in finite **substance**, and (iii) in infinite substance; (3) whether, and in what sense (or senses), Descartes is an essentialist; and (4) how essences or **definitions** are known. Questions regarding the ontology of Cartesian essences are treated elsewhere (see **true and immutable nature** and **universal**).

The first question may be answered via the second. How essence differs from existence *in general* is straightforward enough: the essence of a thing is the answer to the question “What is it?” (*Quid est?*) as opposed to “Is it?” (*An est?*). The difference can be illustrated by a mathematical example from the Fifth Meditation:

When, for example, I imagine a triangle, even if perhaps no such figure exists, or has ever existed anywhere outside my thought, there is still a determinate nature, or essence, or form of the triangle which is immutable and eternal, and not invented by me or dependent on my **mind**. This is clear from the fact that various properties can be demonstrated of the triangle, for example that its three angles are equal two right angles, that its greatest side subtends its greatest angle, and the like. (AT VII 64, CSM II 44–45)

Here two properties are said to follow from the essence of a triangle, loosely defined in the *Principles* as “a [plane] figure made up of three [straight] lines” (AT VIIIa 28, CSM I 212). The triangle’s true and immutable nature (AT VII 68, CSM II 47) or essence is contrasted chiefly with its existence but also with “invented” natures represented by “factitious” **ideas** (cf. AT VII 38, CSM II 26); in the *Principles* (where the language of “the Schools” for which the work was written figures more prominently), *genus* and *propria* are distinguished from *accidentia*. The latter are attributes that things of a certain genus may happen to have, but may also lack without ceasing to be *what* they are – triangles, for example, or bodies, or minds. As Descartes puts it in the Fourth Replies, “If something can exist without some attribute, then it seems to me that that attribute is not included in its essence” (AT VII 219, CSM II 155). Thus, a triangle *may* be right-angled, this being a species of the genus “triangle”; and it *may* be in **motion**, motion being an accident or, in Descartes’ preferred terminology, a mode, not just of triangles and other geometrical figures, but also of extended substances.

The terminological innovation is no whim, however. Traditionally, “a given attribute is essential to an object if its loss would result in the destruction of that object, whereas an attribute is a mere accident if the object would remain identifiably

and substantially the same without it” (Copi 1968, 151). This still holds for Descartes (see the remark just cited, and the subsequent **wax** example), who does not merely substitute new terms for old, however, but draws the distinction in a new way. Modes differ from principal attributes in that a substance can exist and be clearly and distinctly conceived apart from any one of its modes (**body** without **shape** or motion, mind without affirmation or recollection), but not without its principal attribute (**extension** or **thought**); between the latter there is only a rational distinction, between the former a modal distinction, while between two substances (or between their respective principal attributes or modes) there is a real distinction (cf. AT VIIIA 28–30, CSM I 213–15) (see **distinction [real, modal, and rational]**).

It is in these Scholastic terms that Descartes inherited the vexed question of the difference between essence and existence in finite and infinite substance. Regarding created things, he plumps (after some wavering) for a rational or conceptual distinction, where **Aquinas** defended a real and **Scotus** and **Suárez** sought a middle ground between a real and a *purely* conceptual distinction (see **existence** for a brief discussion of the chief views and the ambiguity of Descartes’ stance). As for infinite substance, Aquinas taught that created things *have* existence (real distinction), while **God** simply *is* existence (*ipsum esse*); later Scholastics dubbed the latter a conceptual distinction having no real *intrinsic* basis (in God himself) but with a real extrinsic basis in finite things (cf. Owens 1985, 37n). Descartes is chary of details, but for him too God’s essence and existence are “almost the same thing” (AT III 396, CSMK 186).

So much for the first two questions. Regarding the third, it is clear that Descartes was an essentialist in the weak sense that he recognized what are now called “*de re* necessary properties” (Secada 2000, 271 n. 7) – that is, properties that belong necessarily to a certain kind of thing (*res*) either as *constituting* or as *following* from its essence, and not just owing to **language** or conventional definitions, the latter being what are now called *de dicto* necessary properties. (This independence of the human will is explicit in the contrast between ideas of “immutable and eternal” and “invented” natures in the previous quotation.) Whether or not Descartes was an essentialist in the stronger sense depends on whether he held, “first, that one cannot know the existence of any substance ... without knowing its essence ..., and, secondly, that one can know the essence ... of some substance without knowing its existence” (Secada 2000, 8). The first thesis of essentialism as defined here is endorsed in the First Replies: “We must never ask whether something exists unless we already know what it is” (AT VII 107–8, CSM II 78), but this must be squared with the Second Meditation, where Descartes establishes the existence of the “I” before asking “what this ‘I’ is, that now necessarily exists” (AT VII 25, CSM II 17). Turning to body, however, he describes its essence in the Second, Third, and Fifth Meditations before proving its existence in the Sixth (AT VII 74–80, CSM II 51–55). So the second thesis, at least, is uncontroversial.

The last question concerns how the essences of really existing things are known. As noted, Cartesian definitions are not conventional nominal or “logical” (AT VIIIA 8, CSM I 195), but *real* or “essential” (AT VII 78, CSM II 54) (cf. Gewirth 1968, 267; McRae 1976, 9; Miles 1999, 64–66; Secada 2000, ch. 3): they circumscribe in words the real essences of possibly, actually, or necessarily existing things. Yet there can be no question of defining the essence of mind, body, or anything else *per genus et differentiam specificam*, a procedure that befits Scholastic empiricism, with its doctrine of **abstraction** of intellectual from sensible species, but which is antithetical to Descartes’ nativism and intuitionism about essences. That the natural light of **reason** is a source of *a priori* insight into essences is clearest from the discussions of the “I” (mind) and the wax (body) within the Second, and of God within the Third Meditation.

It is striking that Descartes nowhere defines thought, the principal attribute of mind, within the *Meditations*. Where he does provide definitions aplenty (in the **Geometrical Exposition** appended to the Second Replies), he is obligingly employing a synthetic **method** not his own (see **analysis versus synthesis**). In *The Search for Truth*, he concedes “that we must know what **doubt** is, what thought is, what existence is” in order to be certain of the *cogito ergo sum*. “But do not imagine,” he warns, “that in order to know what these are, we have to rack our brains trying to find the ‘proximate genus’ and the ‘essential differentia’ which go to make up their true definition,” adding:

I would never have believed that there ever existed anyone so dull that he had to be told what existence is before being able to conclude and assert that he exists. The same applies to doubt and thought. Furthermore, no one can learn such things or be persuaded of them otherwise than through his own experience and that *consciousness or internal testimony* (*eaque conscientia, vel interno testimonio*) which everyone experiences within himself (*in seipso experitur*).... In order to know what doubt and thought are, all one need do is to doubt or to think. That tells us all it is possible to know about them, and explains more about them than even the most precise definitions. (AT X 523–24, CSM II 417–18; emphasis added)

That which everyone “experiences within himself” is innate in that special “reflective” (cf. McRae 1978, 33–42) or “reflexive-dispositional” sense (cf. Miles 1999, ch. 19) that the nonempirical understanding of “true and immutable natures” always has in Descartes: though nothing is literally imprinted on the mind prior to its thinking, the mind has nonetheless an innate tendency to form certain concepts and grasp certain truths once experience furnishes the appropriate occasion (cf. AT VIIIB 358–59, CSM I 304).

This intuitionism about essences is even clearer in the famous wax example from the Second Meditation, which anticipates the formal discussions of the essence of body in the Fifth Meditation. Here the traditional notion of essence formulated by Copi is used to infer that color, odor, shape, size, hardness, and coldness cannot be essential to body. For they change when a piece of wax is placed near the fire, yet the same wax, the same body remains. The “nature of this piece of wax” consists rather in being “something extended, flexible, and changeable” or in that variable extension in three dimensions without which a body would not be a body (AT VII 31, CSM II 21). On this follows a consideration of the **faculty** of the mind by which the essence of body was discerned: “The perception ... of it is a case not of vision or touch or **imagination** ... but of purely mental scrutiny (*inspectio mentis*)” (ibid.). It is known, in short, through an act of intuition, as is the essence of the mind, in the **knowledge** of which, moreover, the knowledge of God’s infinite essence is implicit:

The mere fact that God created me is a very strong basis for believing that I am made in his image and likeness, and that I perceive that likeness, which includes the idea of God, by the same faculty which enables me to perceive myself. That is, when I turn my mind’s eye upon myself, I understand that I am a thing which is incomplete and dependent ...; but I also understand at the same time that he on whom I depend has within him all those greater things, not just indefinitely and potentially, but actually and infinitely, and hence that he is God. (AT VII 51, CSM II 35)

So the answer to our final question is that the essences of mind, body, and God are known in a manner akin to ostensive definition – though the “pointing” in question is to an intuitively evident deliverance of *inner* experience, to that which is innate in the sense that it requires outer experience only as an occasion for reflexive awareness of that which has been implanted in the mind by God.

See also Definition, Distinction (Real, Modal, and Rational), Existence, Extension, God, Substance, Thought, True and Immutable Nature, Wax

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ETERNAL TRUTH

Descartes took eternal truths to include **common notions** or axioms, such as the proposition that nothing comes from nothing, as well as mathematical **truths**, such as that the radii of a circle are all equal. He claimed in the *Principles of Philosophy* I.49 (1644) that these eternal truths do not presuppose the **existence** of any object external to mind and that they “reside only within our mind” (AT VIIIA 23–24, CSM I 209).

However, Descartes also held in the Fifth Meditation (1641) that eternal truths concerning mathematical figures such as triangles derive from “**true and immutable natures**” that are themselves “eternal” and “not produced [*effecta*] by me or dependent on my mind [*nec a mea menta dependet*]” (AT VII 64, CSM II 45). This passage may seem to suggest that immutable natures are extramental objects akin to Platonic **ideas**. Indeed, there is the claim that the view in this Meditation is “thoroughly Platonic” and that Descartes “is the founder of modern Platonism” (Kenny 1970, 692–93; cf. the more “moderate Platonist” readings in Schmaltz 1991 and Rozemond 2008). Nonetheless, this Platonic reading seems to conflict with the “conceptualist” suggestion in the *Principles* that eternal truths are reducible to features of our own **mind**. On the basis of this suggestion, one commentator has concluded that “nothing is more contrary to **Cartesianism** than the realism of Platonic ideas and the exemplarism of **essences**” (Gueroult 1984, I 277).

In order to reconcile the conceptualism of the *Principles* with the position in the Fifth Meditation, there is the argument in the recent literature that the claim in the latter text that immutable natures do not depend on us indicates only that such natures are not constructed by us but rather are encoded in our innate ideas (as, for instance, in Chappell 1997 and Nolan 1997). The conclusion here is that “there is nothing ... that commits Descartes to a transcendental realm of extra-mental objects” (Nolan 1997, 183–84).

Nevertheless, it seems that **God’s** nature, at least, cannot be reduced to our innate idea of God given the conclusion in the Fifth Meditation that this nature is identical to God himself. Moreover, there is some question whether the identification of immutable natures of creatures with innate ideas can fully accommodate

the claim that these natures are *eternal*. For Descartes indicated that all creatures, including our minds and their modifications, have a merely temporal duration, and thus lack God's own eternal existence. So, it seems, either these immutable natures and the eternal truths concerning them reside in God, or they cannot be said to be eternal in any strict sense.

One reason for Descartes to reject the horn of the dilemma that takes the natures and truths to reside in God derives from his famous – and infamous – doctrine of the creation of eternal truths. He introduced this doctrine in a 1630 **correspondence** with **Mersenne**, in which he announced a work on the metaphysical foundations of **physics** (never published) that was to include a defense of the thesis that God is entirely free in creating the eternal truths of **mathematics** as an efficient **cause**. In defending this thesis against the more traditional Scholastic view that eternal truths are grounded in uncreated ideas in the divine **intellect**, Descartes insisted that the truths and natures that God freely creates are “no more necessarily conjoined to his essence than other creatures are” (AT I 152, CSMK 25). The suggestion here is that the natures that ground eternal truths concerning creatures are themselves creatures distinct from God.

There is the view in the literature that Descartes' doctrine of the creation of eternal truths is not limited to such truths concerning creatures but in fact has universal scope. In this view, even the eternal truth that God exists is subject to God's indifferent will (see, e.g., Frankfurt 1977 and Bennett 1994). Though Descartes himself spoke at times as if his doctrine has unrestricted scope, there is a reason to restrict this scope that is connected to his view in the Third Meditation that God is *causa sui*, a cause of his own existence (see **cause**). In his subsequent discussion of this view, it becomes clear that the claim is not that God is an efficient cause of his own existence but rather that God can be called *causa sui* only because his nature serves as a kind of formal cause of his existence. But if God's existence has no efficient cause, then it seems that the eternal truth that God exists has no efficient cause either and thus cannot be counted among the eternal truths that derive from God's indifferent will (for a further defense of this position, see Schmaltz 2011).

Another issue that Descartes' doctrine of the creation of eternal truths raises concerns the modal status of the eternal truths that God creates. One prominent view is that this doctrine commits Descartes to a “universal possibilism” on which eternal truths are “as inherently contingent as any other propositions” (Frankfurt 1977, 42). However, this view runs up against the textual fact – documented later in this entry – that Descartes himself insisted that God not only creates the eternal truths but creates them *as necessary*.

Among those who accept the necessity of Descartes' eternal truths, there are different accounts of the nature of this necessity. One view – in line with the conceptualist reading of Descartes indicated earlier – is that this necessity consists merely in our inability to conceive of the world in a way that conflicts with our innate ideas

(Bennett 1994). However, there is the problem here – also raised earlier in connection with a conceptualist reading – of the Fifth Meditation account of God’s existence. According to this account, God’s external nature itself imposes the necessity of his existence on our thought. Moreover, Descartes suggested a more robustly metaphysical notion of the necessity even of eternal truths concerning creatures when he claimed that the immutability of these truths is grounded in the immutability of the divine will itself. The indication here is that once God has willed that the eternal truths be true, such truths must hold and cannot be otherwise.

One proposal for capturing the more robust sort of necessity involved in the case of created eternal truths appeals to iterated modalities (Curley 1984). This proposal is based on Descartes claim in correspondence that “even if God has willed some truths to be necessary, this does not mean that he willed them necessarily; for it is one thing to will that they be necessary, and quite another to will this necessarily, or to be necessitated to will it” (AT IV 118–19, CSMK 235). In particular, the proposal is that this letter endorses the view that created eternal truths are only *contingently* necessary and thus contrast, perhaps, with eternal truths concerning God’s nature that are *necessarily* necessary. However, there is some question concerning the sense in which created truths could have been otherwise. Descartes himself indicated in the 1630 correspondence that introduces his creation doctrine that the necessity of created eternal truths is grounded in the fact that the divine will that creates them is itself immutable: “It will be said that if God had established these truths he could change them as a king changes his laws. To this the answer is: Yes he can, if his will can change. ‘But I understand them to be eternal and unchangeable.’ – I make the same judgment about God” (AT I 145–46, CSMK 23). But given the immutability of the divine will, it cannot *now* be the case that God can make the eternal truths he has created to be false. So it cannot *now* be the case that there are other possible truths that God could have created. Rather, the view appears to be that what is now impossible because of an eternal divine decree God could, from eternity, have made to be necessary.

In defending his doctrine of the creation of eternal truths, Descartes noted that “since God is a cause whose power surpasses the bounds of human understanding, and since the necessity of these [eternal] truths does not exceed our **knowledge**, these truths are therefore something less than, and subject to, the incomprehensible power of God” (AT I 150, CSMK 25). The indication here is that one motivation for affirming that God can bring about from eternity that other truths be necessary is that such an affirmation is required by the view that God has an omnipotence that is beyond what we can conceive.

But, of course, one may then ask at this point why Descartes thought that divine omnipotence must be incomprehensible in this way. One answer is that “it is *primarily God’s simplicity* that requires that God created the eternal truths” (Walski 2003, 24). As Descartes himself explained in his 1630 correspondence on his creation doctrine,

“in God willing and knowing are a single thing in such a way that by the very fact of willing something he knows it and it is only for this reason that such a thing is true” (AT I 149, CSMK 24). In a later letter, he invoked the authority of **Augustine** in defending this view of divine simplicity. He cited in particular the claim in Augustine that “they are so because thou see’st them to be so,” which he understood to require that “in God *seeing* and *willing* are one and the same thing” (AT IV 119, CSMK 235). According to Descartes, then, it follows from an Augustinian account of divine simplicity that God’s seeing that certain eternal truths hold necessarily is simply the same as his act of willing that they so hold.

It might be thought that this point about divine simplicity precludes the distinction – previously attributed to Descartes – between created truths concerning creatures and uncreated truths concerning God himself. However, one could preserve the distinction by restricting the point about divine simplicity to the rejection of a certain account of divine creation. On a traditional Scholastic view – accepted, as we will discover, by some of Descartes’ own followers – God’s creation of the world is conditioned by a **knowledge** of this world that derives from the uncreated ideas of creatures contained in his nature. Descartes can be read as taking divine simplicity to require that God cannot know anything other than himself apart from his act of creation. In creating the world, God must produce *ex nihilo* not only the actual existence of creatures but also the very being of those creatures as reflected in their natures. Such a view, at least, seems to be all that is required by the purported view in Augustine that God’s seeing that creatures have a certain nature is not distinct from his willing that they have that nature.

Among Descartes’ successors, one of the most enthusiastic supporters of his doctrine of the creation of the eternal truths was the French Cartesian **Robert Desgabets** (for a survey of the later Cartesian reception of this doctrine, see Rodis-Lewis 1981). Desgabets praised “the important doctrine of Descartes” of the creation of eternal truths as the one “so elevated, so beautiful, so holy and so worthy of God” (Desgabets 1983–85, 6:209), and he invoked the very same passage from Augustine that Descartes had cited earlier in support of this doctrine. However, Desgabets developed the doctrine in ways that go beyond anything found in Descartes. Desgabets held, for instance, that God creates eternal truths by creating **substances** that have an “indefectible” or indestructible existence that is outside of time. The basic motivation for this view derives from the suggestion in Descartes that the created ground of eternal truths concerning creatures is itself eternal. Yet, as Desgabets himself recognized, his account of the indefectibility of substance requires a rejection of the position in Descartes that all features of the created world have a temporal duration (see **time**). According to Desgabets, only **modes**, and not the substances they modify, have such a duration.

Desgabets took sides with respect to the issues raised concerning the interpretation of Descartes’ doctrine of the creation of eternal truths. First, it is clear that on

Desgabets' version, this doctrine is restricted to truths that are grounded in created but indefectible substances, and it thus does not include truths concerning God's own uncreated nature. Also, by linking the necessity of the truths to the indefectibility of created substances, it is clear that the necessity that Desgabets attributes to created eternal truths is not merely of a conceptualist nature but is robustly metaphysical. Finally, Desgabets insisted that there are no possible substances other than those God has created, and thus no possible truths concerning such substances that God can actualize. He thus is committed to rejecting one sense of the claim that the eternal truths that God has created are merely contingently necessary.

Desgabets' particular version of the doctrine of the creation of eternal truths had a profound influence on another prominent Cartesian, **Pierre-Sylvain Régis**. Régis called Desgabets "one of the greatest metaphysicians of our century" (Régis 1996, 639), and in his own writings he claimed, in line with Desgabets' own position, (i) that created eternal truths have a "hypothetical necessity" that is distinct from the "absolute necessity" of truths concerning God, (ii) that this hypothetical necessity is grounded in the indefectible and atemporal existence of created substances, and (iii) that there are no unactualized substances, and so no truths concerning them, possible or otherwise (for the relation between Régis and Desgabets on these points, see Schmaltz 2002).

Nevertheless, there also was what one French commentator has called a "**Cartesianism** without the creation of eternal truths" (*cartésianisme sans création des vérités éternelles*) (Gouhier 1978, 156–64). This sort of Cartesianism was particularly popular among followers of Descartes who were committed to an interpretation of Augustine that contrasts sharply with the interpretation that Descartes and Desgabets invoked in support of the doctrine of the creation of eternal truths. On this alternative interpretation, Augustine insisted that the eternal truths we know are grounded in God's own uncreated ideas. The most prominent proponent of this interpretation among the later Cartesians was **Nicolas Malebranche**, who offered a grand synthesis of Cartesian **philosophy** and Augustinian theology. Malebranche rejected the Cartesian doctrine of the creation of eternal truths on the grounds that it introduces skepticism concerning our knowledge of eternal truths, including those truths that provide a foundation for Cartesian physics. Though we have seen the response in Descartes that created eternal truths can be necessary because the divine will from which they derive is immutable, Malebranche countered that since he cannot "clearly conceive that God could not have willed certain things, for a certain time, for a certain place, for certain people or for certain kinds of beings – given, as some would have it, that he was entirely free and indifferent in his willing," he also "can conceive no necessity in indifference," nor "reconcile two things that are so opposite" (Malebranche 1997, 615). Our knowledge of the basic principles of Cartesian physics can therefore be secure only if it is grounded in an uncreated and necessary "intelligible extension" in the divine intellect that conditions God's creation of the material world. This is one aspect of Malebranche's doctrine of the Vision

in God, according to which we know objects not by means of our own **perceptions**, but rather by means of ideas in God that are independent of his will.

Vision in God drew a heated response from the theologian **Antoine Arnauld**, a supporter of Descartes who also was a prominent Jansenist (see **Jansenism**). In his polemic with Malebranche over the nature of ideas, however, Arnauld did not offer a defense of Descartes' doctrine of the creation of eternal truths. Rather, he restricted himself primarily to a critique of Malebranche's claim that we perceive objects by means of "representative beings" distinct from the perceptual modifications of our soul. Arnauld insisted that Descartes himself indicated that we perceive objects by means of ideas that are identical to such modifications (see **idea**). This exchange over the nature of ideas was part of an extended and closely followed debate between Arnauld and Malebranche that concerned various philosophical and theological issues, including the issue of the proper use of philosophy in theology (see Moreau 1999).

In later writings that were not directed primarily to Malebranche, Arnauld also defended the position that we can know only a "created truth" grounded in created aspects of our own mind, and not the eternal truth grounded in God's uncreated nature. Here, Arnauld explicitly distanced himself from "the philosophy of Plato" found in Augustine, preferring instead the purported implication in **Thomas Aquinas** that, strictly speaking, the necessary truths that we know are not themselves eternal (Arnauld 2001, 54–55, 99). In these writings, there is still no explicit defense of Descartes' doctrine of the creation of eternal truths (as emphasized in Faye 2005). However, Arnauld did offer an alternative there to the attempt in Desgabets and Régis to ground eternal truths concerning creatures in something other than God's own nature.

See also Arnauld, Antoine; Augustine, Aurelius; Cartesianism; Cause; Common Notion; Desgabets, Robert; Essence; God; Idea; Jansenism; Malebranche, Nicolas; Régis, Pierre-Sylvain; Suárez, Francisco; Time; True and Immutable Nature; Truth; Universal

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TAD M. SCHMALTZ

EUSTACHIUS A SANCTO PAULO (EUSTACHE ASSELINE) (1573–1640)

Eustachius studied philosophy and theology in Paris, obtained a "license" in 1604, and taught philosophy at the Collège de Calvi, an arts college associated with the Sorbonne. In 1606 he entered the Feuillants, a Cistercian order, and became

involved in the education of the members of the order. Eustachius was the author of the *Summa philosophiae quadripartita* (1609), an influential survey of late Scholastic Aristotelianism. Its four parts cover the main areas of **philosophy**: logic, ethics, natural philosophy, and **metaphysics** (see Ariew et al. 1998, 69–71). In a letter to **Mersenne** from 1640, Descartes remarked that he had bought a copy of this work, “the best book of its kind ever made” (AT III 232, CSMK 156). He intended to print it with critical comments to compare traditional Aristotelianism with his own philosophical program, but he never carried out this plan. The reasons are unclear. Perhaps he feared that an open attack on Scholastic philosophy would upset traditional philosophers, especially those teaching in the universities, and prevent them from approving his *Meditations*. Perhaps he was busy with other projects in subsequent years, in particular with his extensive **correspondence** and his replies to the objections written against the *Meditations*. Or perhaps he abandoned the project because he was unable to secure Eustachius’s permission, since the latter died in 1640 (see AT III 260, CSMK 161).

The *Summa*, which combines elements from Thomism and Scotism, contains many traditional doctrines, among them syllogistic logic, hylomorphism, an account of the four Aristotelian **causes**, and a theory of categories. It is hardly surprising that Descartes chose it as the target of his critique because it provided a much shorter account of traditional Aristotelianism than the long **Jesuit** commentaries, known as the “**Conimbricenses**,” or the extensive treatises by **Franciscus Toletus** and **Antonius Rubius** (Gilson 1913, Ariew 2011). He believed that anyone who had the chance to read his comments on this book would easily see its deficits and “learn to scorn it at the same time” (AT III 259–60, CSMK 161).

Despite this harsh critique, there are striking similarities between the Scholastic doctrines expressed by Eustachius and Descartes’ own opinions (Van der Pitte 1988). The most obvious parallel is in the theory of **ideas** (Perler 1996). Descartes emphasized that each idea can be taken in two ways, namely “materially” as the act of thinking and “objectively” as its content (AT VII 8, CSM II 7) (see **being, formal versus objective**). This distinction was also drawn by Eustachius (and before him by **Suárez** as well as by other Jesuit authors), who claimed that what is in the **intellect** can have “subjective” and “objective” being (*Summa*, Metaph. I, tract. 1, disp. 2, q. 3). What has subjective being is an act (sometimes also a disposition) that exists in the intellect as in its subject. What has objective being is the object that is “actually present to the knowing intellect,” whether or not there is a corresponding object in the material world. Eustachius thereby made clear that an act has a content given in the **mind** and to the mind.

See also Being, Formal versus Objective; Conimbricenses; Idea; Jesuit; Scholasticism

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DOMINIK PERLER

EXISTENCE

This concept raises four main questions:

1. What exists?
2. What modes of existence are there?
3. Where does existence itself figure in Descartes' ontology?
4. Is existence a "real predicate" (Kant)?

As for the first two queries, Descartes' official ontology includes three kinds of entities (**substances**, **attributes**, and **modes**) and two ways of existing (formally and objectively) (see **being, formal versus objective**). Formal existence is either necessary and eternal (**God** and his attributes) or contingent and temporal (created **minds** and bodies with their attributes and modes). Talk of the objective reality or existence *of things* in the mind is just Descartes' Scholastic way of saying that *ideas* of them exist there formally (cf. AT VII 102, CSM II 74–75), while talk of the objective reality *of ideas* refers to their representational content (cf. AT VII 40, CSM II 28–29). A further type of entity is mooted in the *Principles*: the **eternal truths** "have no existence outside our **thought**" (AT IXA 22–24, CSM I 208–9). In his

correspondence, however, Descartes insists that the eternal truths exist also in the divine **intellect**. Being no deceiver, God has implanted them in human minds as well (cf. AT I 145, CSMK 23), but whether Descartes is at bottom a Platonic realist who considers **essences** (the objects of eternal truths) to be *universalia extra res* rather than *in rebus* (cf. Schmalz 1991), or a conceptualist who reduces them to the objective reality of **innate ideas** (cf. Nolan 1997a), is controversial.

Similar puzzles about “existence outside our thought” arise regarding **universals** (cf. AT IXA 27, CSM I 212), those “common natures” (AT X 420, CSM I 45) or universal attributes (AT IXA 26, CSM I 211) among which Descartes includes existence (*ibid.*), and the “principal attributes” thought and **extension** (cf. AT IXA 25, CSM I 210–11). Insofar as they “reduce to substances outside our thought, and to mere words or names” within it (Nolan 1997b, 131), Descartes is a nominalist or a conceptualist concerning attributes, and it would be better to speak of a “substance – mode ontology” (*ibid.*) in which attributes reduce to *modi cogitandi* (in a sense reminiscent of the Scholastic *ens rationis*). This brings us to the third question.

Burman reports Descartes as saying that “besides the attribute which specifies the substance, there must also be conceived the substance itself, which lies under the attribute” (AT V 156). This has led Kenny (1968, 66) and Curley (1969, 9) to conclude that the *principal* attributes, at least, are not just “identical in reality” (Nolan 1997b, 129) with the substances whose attributes they are, but are something substances *really have* (see, however, Woolhouse’s demurrer, 1993, 19). As for existence, in a letter to an unknown correspondent (see AT IV 348–50, CSMK 279–81) Descartes lists it along with duration and number as a universal attribute of existing things. He designates them *modi cogitandi* (so already at AT IXA 26–27, CSM I 212) to distinguish them from “modes, strictly so called,” like figure and **motion** in body and “love, hatred, affirmation, doubt” in minds. Since the latter *really exist in* the things whose modes they are, Descartes’ point may be that the attributes “under which we consider” things as existing, enduring, numbered, ordered, and so on, exist *only* “in our thought,” especially as “the distinction between these attributes” is now said to be a “lesser,” or “formal,” one, having misleadingly been called “modal” in the First Replies and “conceptual” in the *Principles* (see **distinction [real, modal, and rational]**).

Nevertheless, Descartes may subscribe to at least a minimal realism such as **Scotus** and **Suárez** opposed to the robust Thomistic doctrine of a real distinction between essence and existence in existing things. For **Aquinas**, essence and existence are not distinct entities so much as correlative principles really present in finite created entities (cf. Owens 1985, 142–44); were they only conceptually distinct (two ways of conceiving one and the same entity), the Christian conception of creation would be untenable. Without recognizing anything of the order of a really distinct “act” of existence received from God, Scotus and Suárez sought a middle ground between a real and a *purely* conceptual distinction of the sort Descartes evokes in

this letter when he notes that Peter may be considered now as an individual, now as a man *within my thought*, although “in Peter himself [i.e., really], being a man is nothing other than being Peter.” What makes the entire letter so ambiguous is that, while clearly denying any modal distinction such as obtains, for example, between two ideas of Peter in the same (or different) minds, Descartes vacillates on whether the “formal” or conceptual distinction he there posits between existence and essence has “a foundation in reality.” In the absence of *any* foundation in reality, the distinction between existence and essence is, *ontologically speaking*, “not a distinction” at all (Nolan 1997b, 138). And Descartes says as much, speaking of the triangle that exists “outside thought”: “It seems to me manifest that essence and existence are in no way distinct.” Yet a few lines earlier he remarks that he does “not recognize any distinction made [solely] by **reason**, that is, one which has no foundation in reality” – in Scholastic terms, a *distinctio rationis ratiocinantis* as opposed to the sort of *distinctio rationis ratiocinatae* defended by Suárez as capturing the intent of Scotus’s “formal” distinction (cf. Heidegger 1975, §10). This suggests that the distinction between essence and existence has a foundation in reality, that it is *not* just “confined to our thought” (Nolan 1997b, 131) after all. Yet the examples of Peter and the triangle speak against the idea that existence is something real in existing things. To top it all off, the body of the letter concludes: “So, then, I postulate three kinds of distinction: first, real distinction between two substances, then modal and formal distinctions, which [latter formal or conceptual distinctions] are distinctions of reason *ratiocinatae*. All these can be called real [here meaning: *either* real *or* having a foundation in reality] in contrast to the distinction of reason *ratiocinantis* [*without* a foundation in reality]; and in this sense it can be said that essence is really distinct from existence” (AT IV 350, CSMK 281).

It is not hard to understand why the often unorthodox but always circumspect Descartes would wish his elusive doctrine to be in at least *verbal* accord with those of Aquinas and Scotus. For an orthodox Christian philosopher, something real must be received in the act of continuous creation through which finite things first come into existence and endure from one moment to the next. It is likewise of great importance for the **ontological argument** that existence be an attribute or predicate *really* present in the substance whose attribute it is; for the proof turns on the idea that necessary existence is a perfection belonging to God’s nature, much as having three angles equal to two right angles belongs to that of a triangle. This may be the purport of the axiom: “Existence is contained in the idea or concept of every single thing, since we cannot conceive of anything except as existing. Possible or contingent existence is contained in the concept of a limited thing, whereas necessary and perfect existence is contained in the concept of a supremely perfect being” (AT VII 166, CSM II 117; cf. also AT VII 117, CSM II 83). That is as far as the fourth question can be pursued here. The fact remains, however, that certain passages point to a nominalism or conceptualism that takes no account of these important theological stakes.

See also Aquinas, Thomas; Being, Formal versus Objective; Distinction (Real, Modal, and Rational); Essence; Eternal Truth; Metaphysics; Ontological Argument; Scotus, John Duns; Suárez, Francisco; Universal

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MURRAY MILES

EXPERIMENT

Descartes is not usually associated with an empirical, let alone experimental, approach to science. According to the textbook version of Descartes' **philosophy**, the fundamental principles of Cartesian **physics** are established independently of all experience; all one has to do would be to identify them through a process of systematic **doubt** and to justify them with an appeal to divine veracity. Although this idea of Cartesian science is not entirely false, there is considerable room for qualification. Moreover, Descartes' **correspondence** shows that, despite a deep distrust in the observations and experiments of others, Descartes rarely rejects them as being irrelevant, usually asks to be informed of the precise circumstances, and quite often suggests new experiments of his own. The bottom line, however, is that for him no observation or experiment can ever be useful without a correct general theory; without it, experiments are mere "curiosity," which, being a kind of wonder, is of little use in science (AT X 371, CSM I 16) and even "perverts the use of **reason**" (AT XI 385–86, CSM I 355–56).

The *Discourse* is one of the few places where Descartes explicitly discusses experiments and affirms their necessity. Descartes situates himself in a distinctly

Baconian perspective, emphasizing both the practical and, in a limited way, the collective aspects of science. He also admits the necessity of experiments but is eager to point out their limitations. Observations and experiments are necessary “the more we advance in our **knowledge**” but not when we begin: “If we begin, instead of seeking those [observations] which are more unusual and rather contrived it is better to take those only into account which, presenting themselves spontaneously to our senses, cannot remain unknown after a little reflection” (AT VI 63, CSM I 143). Unusual observations (which includes experiments) would be misleading if we did not know the **explanation** of the more general ones.

As a result, Cartesian natural philosophy, or physics, consists of two levels: one dealing with the most *general* features of nature and based on ordinary experience, and the other dealing with particular effects. The first level, general physics, in turn, can be divided into two parts: the derivation of “the principles or first **causes** of everything” from “seeds of **truth** that are naturally in our souls”; and an examination of the “first and most ordinary effects that can be deduced from those causes” (AT VI 64, CSM I 144). As to the other level, special physics, Descartes declares, on one hand, that we should construct models for particular classes of phenomena that fit both our theoretical principles and our observations, whereas on the other hand he admits that “the power of nature is so ample and so vast and these principles so simple and so general” that there are “no other means to discover [the true cause] than by seeking further observations whose outcomes vary according to which of these ways provides the correct explanation” (AT VI 64–65, CSM I 144; cf. *Principles* III.4).

Although the general physics is an essentially individual project, given the fact that the principles are identified through a process of reflection and doubt, this does not mean that it has nothing to do with experience at all, given the fact that the effects deduced from the most general principles must be confirmed by our most general observations. Thus, for example, in the *Principles* Descartes illustrates his second law of nature (according to which a body in **motion** tends to continue its motion along a straight line) with the “experiment” of a stone moved in a sling (AT VIIIA 64; cf. AT XI 43–47, CSM I 95–97). On the other hand, he is not prepared to give up his general principles or any of the laws deducible from them on the basis of particular observations or experiments. Thus, for example, he does not accept empirical arguments against his laws of collision because “the demonstration is so certain that even if experience would seem to show the contrary, we would still be obliged to attach more belief to our reason than to our senses” (AT IXB 93).

There are two fundamental differences between general physics (the principles, the **laws of nature**, and the laws of collision) and the special physics. First, it is only on the basis of the general principles and laws that we can determine the type of causes by which to explain a particular kind of effect. Thus, **magnetism**, which is a special effect, is explained by means of a specific particle, which, even though no one could foresee that it would exist on the basis of general physics, fits the general

principle that the world consists of matter in motion, since it has the same properties as other particles (size, **shape**, motion) (see *Principles* IV.133–40). We should resort to explanatory principles that cannot be accounted for in general physics only if we are dealing with an effect that cannot be reduced to matter and motion (such as language and thinking) (AT VI 57–59, CSM I 140–41). The second difference concerns the status of the notion of cause. On the level of general physics we reason from the certain knowledge of a cause to knowledge of effects, which follow necessarily, whereas the causes that explain a given effect on the second level are no more than probable, although, according to Descartes, their probability is almost a certainty and in any case suffices for practical purposes (AT VIIIA 326, CSM I 288). According to him, a philosopher has done all he can and must do if he assigns a given effect to a *possible* cause (AT VIIIA 327, CSM I 289). The role of experiments therefore is mainly to strengthen the probability of an explanation provided on the second level of physics: if a certain effect can have more than one cause that fits the general principles, we should try to eliminate some of them by means of an experiment (Buchdahl 1969 96–97, 118–26; Sabra 1967, 21–45; Clarke 1977, 333–44). Finally, given the fact that without a correct understanding of the principles, observations and experiments are almost necessarily misinterpreted, Descartes usually distrusts the observations and experiments of others and is eager to repeat them for himself.

Beyond all the foregoing conditions that Descartes placed on the use of experiment, it is also important to understand his willingness to co-opt the experiments of others for theoretical purposes – for example, his adoption of Gilbert’s experiments on magnetism and his systematic reinterpretation of them to support and articulate his mechanistic **cosmology** (Schuster and Brody 2013). Similarly, he radically reinterpreted much of **William Harvey**’s empirical work on the circulation of the blood, in the service of his own mechanistic physiology (Gaukroger 1995, 271–72). Moreover, Descartes could display a very sophisticated grasp of the interplay of experimental work and detailed theorizing – for example, in his explanation of the geometrical and chromatic properties of the **rainbow**. Indeed, it has been shown that within one small corner of this project he achieved the only instance in his work where a corpuscular-mechanical model is applied and further articulated with relation to novel experiments that have quantitative implications, thus prefiguring **Newton**’s optical work and foreshadowing just the kind of interaction between physical models and quantified, novel experimental manipulations that characterize the explanatory and practical style, and content, of all subsequent physics (Buchwald 2008).

Finally, Descartes demonstrated time and time again in his voluminous correspondence that he had an overwhelming interest in experiments and gathering of hands-on experience in all fields, from lens grinding to animal anatomy, from medicinal botany to aerostatics, from medical diagnostics to pendulum motion (Clarke 2006, 234, 304–5, 322–23). For example, all the theoretical and practical

issues involved in experimentation, as understood by Descartes, came to the fore in his discussion of the experiments with the mercury tube by Étienne Pascal (1588–1651) and his son **Blaise Pascal** (1623–62) – experiments first performed by Torricelli (1608–47). In these proceedings, dominated by both practical and theoretical debate, Descartes repeatedly demonstrated that he was a canny tactician and negotiator about novel, experimentally based knowledge claims (Clarke 2006, 353–59). Indeed, in his compulsive concern for experimental information and observational novelties, Descartes was not so different from those supposedly much more experimentally oriented savants one finds half a generation later at the Royal Society of London. What Descartes lacked, compared to the later “experimental philosophers,” was a genuine commitment to collaborative research among recognized peers, which would include a willingness to modify basic theoretical commitments in the light of experimental evidence, and an imperative toward new organizational modes to facilitate the same (Schuster 2013, 595–96; Schuster and Brody 2013, 44–45).

See also Anatomy and Physiology, Cause, Cosmology, Explanation, Heart, Law of Nature, Magnetism, Physics, Rainbow

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EXPLANATION

Descartes' views on explanation are best approached against the background of traditional and contemporary views on the topic. There are no entries on *explanatio* or *explicatio* in the philosophical dictionaries of the early modern period. Normally Scholastic writers talked not about *explanations* of natural phenomena but about their *demonstrations*, by way of **sylogisms** yielding apodictic knowledge of causal dependence (Jardine 1976; Dear 1995, 26–30). By contrast, the etymology of *explanation* and *explication* (in English, Latin, and French) reveals related senses of clarifying, removing ambiguities, and making intelligible that do not implicate the notion of *demonstration*. This range of senses is in Cicero, who refers to **physics** as *explicatio naturae*, a label borrowed for the same purpose by some writers in the early modern period. *Explicationes* appear in Scholastic manuals as commentaries or philosophical *explications de texte*, not typically as causal accounts of natural phenomena. A Scholastic demonstration is an *explicatio* to the extent that it interprets and clarifies phenomena in a certain way; an explanation in the new physics is a demonstration to the extent that it yields causal **knowledge**, whether or not it be *scientia* strictly understood. Yet *demonstration* and *explanation* remain different notions, and the differences between them spotlight important contrasts between Peripatetic physics and the new mechanical philosophies. Proponents of these new philosophies sought mechanical explanations of all kinds of properties, including those manifesting the supposed forms and qualities that for the Scholastics were matters of **definition** and of specification of **essences** (see **form**, **substantial** and **quality**, **real**).

Many proponents of the new natural philosophy, including Descartes, retained the ideal of constructing explanations that would count as *scientia*, especially when the problem could be mathematized and the solution derived from assured principles. But they also appreciated the difficulties in constructing unqualified *scientiae* of nature, notably of the biological world (Fouke 1989). Claims to apodictic security became less characteristic of the new mechanical philosophies, where the terms *explanation* and *explication* multiplied in tandem with increasing concerns about whether causal intelligibility could ever be strictly demonstrative. *Explanations* became common coin in the sciences, with *demonstrations* remaining common coin in **mathematics**, pure and mixed, though in the latter, unqualified demonstrability depended on the likelihood of causal demonstrations within the physical world. In the empirical sciences, other explanatory values began to displace strict demonstrability, such as intelligibility, simplicity and minimalization of theoretical principles, unification of laws, and high informational content.

Descartes played a significant role in the gradual shift from “demonstrating” to “explaining.” He defended his use of suppositions in *Dioptrics* and *Meteors* by claiming that his reasonings hang so well together that just as the effects are demonstrated

by their **causes**, so conversely the causes are demonstrated by their effects. However, as he indicates in the *Discourse on Method*,

you must not imagine that here I am committing the error logicians call a circle. Experience makes the majority of these effects very certain, so the causes from which I deduce them serve not so much to prove them as to explain them. In fact it is quite the other way round: it is the causes that are proved by the effects.” (AT VI 76, CSM I 150)

Following his critical reading of the *Discourse* and the *Essays*, **Jean-Baptiste Morin** warned Descartes about the demonstrative circle in a letter of February 22, 1638 (AT I 538). Descartes responded with a gloss on the preceding remarks in the *Discourse*:

You say also that “to prove effects by a cause, then to prove this cause by the same effects, is a logical circle,” which I admit. But I do not admit on that account that it is a circle to explain effects by a cause, then to prove it from them, for there is a big difference between *proving* and *explaining*. To which I add that you can use the term *demonstrating* to refer to both, at least if you take it according to ordinary usage, not with the special meaning that the Philosophers give it. I add also that it is not a circle to prove a cause by several variously known effects, and then conversely to prove other effects by this cause. (AT II 197–98, CSMK 106)

Here Descartes’ implicitly assimilates demonstration “according to ordinary usage” to his own conception of *explication* (*explicatio*), which is more fruitful than demonstration of the Peripatetic kind (Clarke 1982, chs. 5, 6; 1992). His reference to “ordinary usage” (which he does not elucidate) indicates that his was not the only new conception of explanation to have emerged by midcentury.

Of the several kinds of explanation in the early modern period, the most effective consisted in finding a macroscopic model whose workings instantiate a known physical law, principle, or property, and which allow for an analogical representation of a hypothesized physical arrangement whose effects are the *explananda*. The **analogy** might be between a domain in which a law or property is known to apply and a different domain in which it is believed or known to apply with equal validity. It need not be expressed mathematically, since it might depend on laws whose effects have not yet been given mathematical form. This type of explanation was justified by the doctrine of the uniformity of nature, through an appeal to transduction, or what **Newton** called “the analogy of nature.” The same laws govern all parts of nature, and the same or similar corporeal **substances** exhibit the same or similar properties.

Descartes was adept in deploying models in the mathematical demonstrations of the laws of reflection and refraction in *Dioptrics*, the seals of approval being drawn

from the *Rules for the Direction of the Mind*. Rule 8 shows that to find the anaclastic curve (the shape of lenses free of geometrical aberration), we need to know how **light** is refracted, which requires knowing the nature of light, which in turn requires knowing what a natural power is, with which knowledge we can survey known natural powers to find one that will enable us to understand the behavior of light, “if only by way of analogy” (AT X 395, CSM I 29). Rule 14 explains that

in all reasoning it is only by means of comparison that we attain an exact knowledge of the **truth**.... Syllogistic forms are of no help in grasping the truth of things. So it will be to the reader’s advantage to reject them altogether and to think of all knowledge whatever – save knowledge obtained through simple and pure intuition of a single, solitary thing – as resulting from a comparison between two or more things. In fact the business of human **reason** consists almost entirely in preparing for this operation. (AT X 439–40, CSM I 57)

On the nature of light itself, Descartes writes in *Dioptrics* I that

there is no need for me to undertake to say in truth what its nature is, and I think it will be enough if I use two or three comparisons that help me to conceive it in the way that seems the most convenient to explain all the properties that we learn about it from experience, and then to deduce all the others that cannot come to our notice so easily. (AT VI 83, CSM I 152)

Two of these “comparisons” or hypothetical models are a blind man’s stick (light hypothesized as the rectilinear transmission of impulses), and *une balle de paume* (an early tennis ball) bounced off the ground without loss of speed, or receiving an increase or decrease of speed on entering another medium. Descartes’ approval of models is clear from his reaction to the objections arising out of Morin’s reading of *Dioptrics*. Morin has been skeptical about the explanatory value of mechanical *comparaisons*, to which Descartes replies by declaring that *comparaisons* are “the most appropriate way of explaining the truth in physical questions that the human **mind** can have, so much so that when someone affirms something concerning nature that cannot be explained by any such comparison, I think I can tell by demonstration that it is false” (AT II 368, CSMK 122) (see **analogy**).

The inspiration for the **vortex** theory of **gravity** and planetary **motion** was the fact that pieces of wood thrown into a whirlpool congregate at its center (*Principles of Philosophy* III.30). Descartes explains this phenomenon by appealing to the centrifugal forces of the particles of the rotating mass of water, which in turn are explained by his first two **laws of nature**. He argues that the same state of affairs would obtain in a hypothetical vortex of **subtle matter**. Being fluids in rotational motion subject to the same laws of nature, a vortex and a whirlpool will

exhibit similar properties. Descartes then explains gravity and the heliocentric motions of the planets (*Principles* II.39; III.25, 30–31, 56–58, 60–63; IV.23–27.) Like the tennis ball model, the whirlpool model depends on similarities in behavior between different kinds of **body** (water and subtle matter). However, unlike the account of reflection and refraction in *Dioptrics*, the vortex theory was not worked out in mathematical terms, despite its dependence on the first two laws of nature and the in-principle mathematizability of centrifugal **forces**. Nor was it open to the empirical testing that mathematical descriptions of these phenomena might have allowed. Whirlpools are inordinately more complicated than bouncing tennis balls, so it is not surprising that Descartes did not present a mathematical treatment of his vortex theory.

A related category of explanation employed analogies or *comparaisons* between the *explananda* and properties of everyday objects. Writing to **Huygens** in August 1638, Descartes sketches an explanation of amalgams and the actions of acids on metals:

Ordinary acids dissolve metals, though **wax** resists them. Again, they dissolve iron or steel more easily than lead. Quicksilver dissolves gold, tin and lead, though it is scarce able to bind itself to iron or copper, and even less to other non-metallic bodies. The reasons for this are quite easy to imagine for those who know that all bodies are composed of small parts of diverse sizes and figures joined in diverse ways. You can break into a thousand pieces a pile of glasses or earthenware pots by striking them with a stick, whereas nothing happens if you strike with the same stick a pile of hay or wool; and on the contrary, you cannot cut into glass using scissors or knives, but with them you can easily cut the wool. It is not difficult to imagine a body whose parts are such that moved in such-and-such a way they can act against the parts of gold rather than against those of other bodies. (AT II 671–72)

As familiar empirical data, the contrasting properties of the pots and the wool purport to do their limited explanatory work without requiring knowledge of the physical laws that govern both the chemical *explananda* and their empirical analogues. In this respect, such explanations stand in contrast to the theoretical bases of the vortex theory. They appeal to “easy-to-imagine” structural similarities at the particulate level that are common to the *explananda* and corresponding analogues, which are themselves therefore open to further investigation. It is worth noting that this analogical explanation of chemical phenomena and the theoretically grounded vortex theory are both examples of Hempel’s “explanation sketches” (1965, 238, 424).

Another category of explanation lacked appropriately representative models, or depended on the expectation that mechanical hypotheses of some kind would provide explanations of the phenomena. It was impossible or very difficult to corroborate

experimentally the individual causal components of such explanations. More tellingly, they were sometimes circular, thus mirroring a striking weakness of Peripatetic physics (of which some of its practitioners had themselves already been aware). In his reply to Descartes' letter of September 12, Morin writes (October 1638):

I am astonished that you set so much store by comparisons to demonstrate physical things, going so far as to say that when someone affirms something concerning nature that cannot be explained by any such comparison, you think you can tell by demonstration that it is false. Because there can be found in nature so many effects that have nothing that is similar to them, such as the magnet, among others ... I do not deny that one can almost always find comparisons to explain them after a fashion, but it's a matter of explaining them so well that one creates a clear knowledge of the thing under consideration. (AT II 411)

Morin has put his finger on the difficulty. To develop Morin's objection, Descartes' explanatory model for the magnet (lodestone), which depends on the hypothesized motions of grooved particles of the first element (*Principles* IV.133–83), does not *represent* a magnet: it *is* a magnet under a Cartesian mechanical reconstruction, a model that doubles as the object whose properties it is intended to represent and explain. Furthermore, the model cannot be constructed, because a magnet, being a natural object, is not an artifact. There are few practical difficulties with the tennis ball artifact used to explain the reflection and refraction of light, but Descartes does not claim that a bouncing tennis ball *is* light. The tennis ball model succeeds because of the geometrical structure of the representation within which Descartes appeals to his laws of motion and the rules of composition and resolution. By contrast, his descriptive model for **magnetism** does not get beyond being a first-stage Hempelian explanation sketch.

Similarly, mechanical models constructed to explain the qualia of colors, smells, or tastes turn out to be doubles of the real mechanisms offered as their respective causes. In *Discourse VIII* of *Meteors*, Descartes hypothesizes color as the sensory effect of mechanical dispositions of the particles of subtle matter analogous to differing ratios of rotational to linear force of little balls rolling along canals in terrestrial bodies. With a metonymical slide from rolling balls to the subtle matter particles themselves, Descartes can then say that the nature of colors consists

in the tendency of particles of subtle matter, which transmits the action of light, to rotate with more force than to move in a straight line; so that those which tend to rotate much more strongly cause the color red, and those which tend to rotate not quite so strongly cause the color yellow ... green appears

when they rotate scarcely less quickly, and blue when they rotate much less quickly. (AT VI 333–34)

The hypothesis is attractive and plausible, initially because it takes its strength from analogies suggested by commonly experienced links between degrees of physical activity and their observed effects: from the redness of fires domestic and public, for example, to the blueness of icy water, with yellowness and greenness occupying positions in between. This model and the related tennis ball model exemplify the theoretical consistency that Descartes valued, and whose warrant was the universality of the laws and principles established in the *Principles* III (see Schuster 2000). Descartes' color hypothesis was successful in that it enabled the first adequate explanation of the empirical data of the **rainbow**, yet its theoretical constituents could not be independently checked experimentally, at least not at that stage in the development of physics (see Buchwald 2008).

In the case of Descartes' explanation of why we involuntarily blink when a friend pretends to punch us in the eye, there is nothing to check, because the explanation is plainly circular:

[Our eyes] do not close through the intervention of our mind, since [the blinking] is against our will, which is the mind's only or at least its principal action. They close because the **machine** of our body *is composed in such a way that* the motion of the hand towards our eyes excites in our brain another motion which conducts the **animal spirits** into the muscles which make the eyelids close. (AT XI 339, CSM I 333–34; emphasis added)

Further instances of explanatory circularity can be found in the work of other major figures of the time, such as **Gassendi**, **Boyle**, and Newton. In all these cases, the *explananda* are caused by hypothetical mechanical structures that are fitted to cause the *explananda* (Descartes' "is composed in such a way that"). Between *explanandum* and *explanans* there is a relation of what the Scholastics called *adaequatio*: being fully representative, equal in some specified sense. It was a generally accepted principle that, as Descartes put it to **Mersenne**, "all natural powers act more or less according as the subject is more or less disposed to receive their action" (AT I 230). That invites the question of how a natural power could ever succeed in *acting* on a subject that is *not* disposed to receive its action. Action and **passion** are indissociable, each being defined and understood in terms of the other. That is why explanations that depend on this general principle reduce ultimately to exercises in tautology.

See also Analogy, Knowledge, Law of Nature, Light, Magnetism, Physics, Rainbow, Vortex

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ALAN GABBEY

EXTENSION

Already in the *Rules for the Direction of the Mind* (1628) Descartes formulated his fundamental theory of extension: "By extension we mean whatever has length, breadth and depth" (AT X 442, CSM I 58). These three dimensions are inseparable in reality: a surface or line is not really distinct from extension but only considered so by an **abstraction** of the **intellect** (AT X 446, CSM I 61). And the difference between them is merely "nominal" (AT X 449, CSM I 63). We can speak of countless other measurable "dimensions" of an extended thing, such as speed or number of parts. But these quantifiable **modes** of extension "add absolutely nothing to the things which possess them" (AT X 448, CSM I 62). Simply put, extension is three-dimensionality.

Anything extended is a **body**. Indeed, we should not say "body possesses extension" since we do not have different conceptions of body and extension: "We might

just as well say ... ‘that which is extended is extended’” (AT X 444, CSM I 60). In *The World* (ca. 1633), Descartes writes that extension is not a mere accident of body but “its true form and **essence**” (AT XI 36, CSM I 92). Later, in the *Principles of Philosophy* (1644), he formulates the same conception using the technical notion of **attribute**. Extension is the “principal attribute” of body: “Extension in length, breadth and depth constitutes the nature of corporeal **substance**” (AT VIIIA 25, CSM I 210). Unlike variable modes, attributes are merely “conceptually distinct” from the substance itself: we can have a clear and distinct idea of body apart from a certain **shape** or **motion**, but not apart from extension. The principal attributes **thought** and extension are “nothing else but thinking substance itself and extended substance itself, that is, **mind** and body” (AT VIIIA 30–31, CSM I 215). Furthermore, there is merely a conceptual distinction among the various attributes of a given substance. Thus, Descartes mentions that a body’s **divisibility** into parts (AT IXB 53, CSM I 215 n. 1) and **quantity** (AT VIIIA 44, CSM I 226) are merely conceptually distinct from its extension (see **distinction [real, modal, and rational]**). This identification of body, extension, quantity, and divisibility is a crucial step in Descartes’ program to mathematize natural **philosophy**: “I recognize no matter in corporeal things apart from that which the geometers call quantity” (AT VIIIA 78, CSM I 247).

Since body and extension are identical, Descartes argues that color, heaviness, and hardness are not essential to body (see **quality, sensible**). Thus, something would remain a body even if it always withdrew from our touch and so never felt hard (AT VIIIA 42, CSM I 224). When **Henry More** objected that bodies must be solid as well as extended, for otherwise they would be mutually penetrable, Descartes simply denied that extension as such is interpenetrable: “It is impossible to conceive of one part of an extended thing penetrating another equal part without thereby understanding that half the total extension is taken away or annihilated” (AT V 342, CSMK 372). This separation of solidity from the nature of body was opposed by many philosophers in the “corpuscular” wing of the mechanical philosophy, notably by **Boyle** and **Locke**.

Descartes found it obvious that “in reality the extension in length, breadth, and depth which constitutes a space is exactly the same as that which constitutes a body” (AT VIIIA 45, CSM I 227). He admits we tend to think of a space remaining after a body has moved, “so long as it retains the same size and shape and keeps the same position relative to certain external bodies” (AT VIIIA 45, CSM I 227). But this idea of a common or “generic” extension shared by two or more bodies, which Descartes labels “internal place,” is a mental abstraction from their similar shapes and relations (see **place, external versus internal**). In reality, the space of any body is its own extension. Since extension is necessary and sufficient for body, it follows that there can be no three-dimensional space void of body – that is, a **vacuum**. Descartes’ main argument against the vacuum relies implicitly on extension’s status as an attribute. He says it is a “complete contradiction that a particular extension should belong to nothing,” whether the extension is supposed to belong to a body or a vacuum: “Since

there is extension in it, there must necessarily be substance in it as well" (AT VIIIA 49, CSM I 230). Given that extension is an attribute, it must pertain to a substance; and given that body and extension are merely conceptually distinct, that substance must be body. Put differently, to show that vacua are impossible, Descartes considers it sufficient to assert that "nothingness cannot possess any extension" because any clearly conceivable subject for extension would be identical in reality to body: "There is no difference between the extension of a space, or internal place, and the extension of a body" (AT VIIIA 49–50; CSM I 229–31). Some seventeenth-century proponents of the vacuum allowed space itself to be the substance of extension (More), while others exempted extension from the substance-attribute dichotomy (**Gassendi** and **Newton**). Since a body is simply the quantity of its extension, Descartes has considerable difficulty explaining the phenomena of **rarefaction and condensation** (AT VIIIA 42–44, CSM I 225–26). Finally, since any part of a body will be extended and hence divisible by nature (AT VIIIA 51–52, CSM I 231), "indivisible body," like "incorporeal extension," is contradictory (AT III 191, CSMK 154).

Although nothing incorporeal can be extended, Descartes grants minds a derivative or metaphorical extension. In his 1649 exchange with More, Descartes says that "in **God** and **angels** and in our own mind I understand there to be no extension of substance but only an extension of power" (AT V 342, CSMK 372). That is, minds can act on various parts of real extension. But Descartes cautions that minds are extended only by analogy, as **medicine** and climates are called "healthy" (AT V 270, CSMK 362) (see **extrinsic denomination**). Descartes is drawing upon the traditional view, developed by Aquinas and others, that God is present everywhere because he always conserves all things. In the 1643 correspondence with **Elisabeth**, he seems to invoke this "extension of power" tradition in connection with the mind-body union (see **human being**). He tells Elisabeth that in order to comprehend mind-body interaction, she "should feel free to attribute this matter and extension to the soul because that is simply to conceive it as united to the body." But she should also keep in mind that the extension of matter is different from thought since the former "excludes all other bodily extension, which is not the case with the latter" (AT 3 694, CSMK 228). Descartes sometimes invokes another traditional way of explaining the relation of minds to extension. In the Sixth Replies, he treats the mind and body as "co-extensive" because "the whole mind is in the whole body and the whole mind in any one of its parts" (AT VII 442, CSM II 298). It is unclear how easily this view, dubbed "**holenmerism**" ("whole-in-part-ism") by **Henry More**, fits with Descartes' contention that "there is a certain part of the body [the **pineal gland**] where it [the soul] exercises its function more particularly than all the others" (AT XI 352, CSM I 340).

Time seems to have a structure analogous to bodily extension, albeit one-dimensional rather than three. Descartes falls in with a tradition, going back at least to Aristotle, which conceives of time as continuous and quantitative, with

parts arranged like the parts of a line. In the second **cosmological argument** for God's existence in the Third Meditation, he relies on the assumption that "a lifespan can be divided into countless parts" (AT VII 48–48, CSM II 33). However, unlike Aristotle, he does not reduce time to the mere "measure of motion": "The duration we understand to be involved in movement is certainly no different from the duration involved in things which do not move" (AT VIIIA 27, CSM I 212). But neither does Descartes make time a substance in its own right. Instead, he classifies duration as a "generic" attribute of all things, which is merely conceptually distinct from things that endure (AT VIIIA 30, CSM I 214). So time is not an additional species of extension but merely "a way in which we conceive a thing insofar as it continues to exist" (AT VIIIA 26, CSM I 211) (cf. Arthur 1988, Gorham 2007).

Since Descartes' world is a **plenum**, he cannot rely on empty space to individuate bodies (see **individuation**). This job is done by relative motion: "By 'one body,' or 'one piece of matter,' I here understand everything which is simultaneously transported" (AT VIIIA 53–54, CSM I 233). Local motion also gives bodies their determinate figures and the consequent diversity we perceive among them (AT VIIIA 52–53, CSM I 232). But we can also consider "body in general," or "matter," apart from the relative motion of its parts. Extension is equally the nature of body in general and particular bodies. But the extension of the former is indeterminate and homogeneous. In the two-stage creation story of *The World*, God first creates undifferentiated matter: "a real perfectly solid body, which uniformly fills the entire length, breadth and depth of this huge space." While noting its similarity to the "formless" prime matter of the Aristotelians, Descartes stresses that matter's dimensions are real and clearly understood. Next, by introducing diverse motions, God "really divides it into many such parts, some larger and some smaller, some of one shape and some of another" (AT XI 34, CSM I 91). In the creation story that appears later in the *Principles*, the two steps are collapsed into one: God "created matter along with its motion and rest" (AT VIIIA 61, CSM I 240). Nevertheless, Descartes retains the fundamental distinction between the principal attribute extension and its changeable modes, shape and motion.

Descartes' view of extension has two important cosmological implications. First, there can be no ontological distinction between the celestial and terrestrial domains. In Aristotelian **cosmology**, the celestial realm is composed of several *sui generis* elements governed by special principles. Descartes' geometrical account of matter implied *a priori* a uniform ontology since **geometry** was assumed to have universal application: "Even if there were an infinite number of worlds the matter of which they were composed would have to be identical" (AT VIIIA 52, CSM I 232). Second, the universe must be boundless since "no matter where we imagine the boundaries to be there are always indefinitely extended spaces beyond them" (AT VIIIA 52, CSM I 232). Descartes cautions, however, that such reasoning fails to establish the actual infinity of extension: "Since we are finite, it would be absurd for

us to determine anything concerning the infinite” (AT VIIIA 14, CSM I 201–2) (see **infinite versus indefinite**).

See also Atom; Attribute; Body; Distinction (Real, Modal, and Rational); Divisibility; Essence; Holenmerism; Individuation; Place, External versus Internal; Plenum; Quantity; Rarefaction and Condensation; Thought; Time; Vacuum

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EXTRINSIC DENOMINATION

Denominatio is the substantivized form of *denominative*, which was the Latin translation of Aristotle’s παρόνυμα, from which we also derive the English “paronym” (Aristotle, *Categories* I.1a13–14). “Extrinsic denomination” (*extrinseca denominatio*) refers to instances of naming where a relation that a thing bears to something outside itself supports using the name, while an “intrinsic denomination” is an instance of naming where a property of the thing itself is the support (see, e.g., Aquinas, *Contra gentiles* II.13). References to intrinsic and extrinsic denominations frequently appear in Scholastic disputes over the names attributed to both **God** and his creation – for example, do names mean the same thing when predicated of the two? Less controversial was Aristotle’s example of “healthy.” An **animal** is intrinsically denominated “healthy” because health belongs to the animal itself. Food, however, is extrinsically denominated “healthy” because it bears a causal relation to the healthy animal – that is, it makes the animal “healthy.” Urine was likewise extrinsically denominated “healthy” because it bears a semiotic relation to the healthy animal – that is, it is a sign of the animal’s health.

This example reveals two further points about extrinsic denomination worth noting. First, in cases of extrinsic denomination there is a primary meaning of a name – for example, “healthy” when applied to an animal – from which all related

uses derive. Little surprise then that extrinsic denominations were identified with **analogies**, and particularly analogies of attribution or “denominatio per attributionem” (Suárez, *Disputationes metaphysicae* XX–VII, sec. III. §4). Second, although there was disagreement over some of the nuances surrounding extrinsic denominations, what remained constant was the understanding that an extrinsic denomination was not the same as a false attribution. Thus, not only does an extrinsic denomination contrast with an intrinsic denomination, but it also contrasts with arbitrary or purely contingent acts of naming.

In Descartes’ work, “extrinsic denomination” (misleadingly rendered “extraneous label” in the CSM translation) makes two appearances – one in the Sixth Meditation and the other in the *Objections and Replies* in response to **Caterus**’s worries over “**objective being**” (AT VII 85, 102; CSM II 59, 74). In both cases, Descartes shows himself well aware of the meaning of “extrinsic denomination.” Consider just the Sixth Meditation, where Descartes discusses the predication of “**nature**.” It is his view that whenever “nature” implies the possibility of error or **privation** in a **body**, it must be a case of “extrinsic denomination” (ibid.). Of course, we are inclined to talk about malfunctions and failures generally with respect to **machines**, but the intrinsic properties of a body and the **laws of nature** governing their states do not allow for this (AT VII 84ff., CSM II 58). To explain the denomination of “nature,” therefore, Descartes argues that we apply “nature” to a machine owing to the relation the machine bears to the **ideas** of its creator. (Presumably, the “nature” of the machine represented in the ideas of its creator is intrinsically denominated in the idea, even though it is, strictly speaking, external to the machine itself.)

Descartes adopts a more complicated position with respect to the human body. It too is extrinsically denominated with a “nature” capable of error and privation, but now it is a relation to the intrinsically denominated “nature” of a composite **human being**, and not to the ideas of its creator, that supports the denomination of “nature” (AT VII 85, CSM II 59). Precisely what this relation is is far from clear in the text of the Sixth Meditation, and how we understand the relation will have implications for our understanding of the mind-body union. One suggestion is that the relation is a product of abstraction; that is, the human body is an abstraction from the composite human being. Where all this leaves the “nature” of animals and other living things in Descartes remains a subject of great controversy.

See also Analogy; Being, Formal versus Objective; Human Being; Nature

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Descartes' doctrine of the indivisibility of the **mind** constitutes one of his two main arguments for the mind-body **dualism** in the *Meditations* (AT VII 85–86, CSM II 59). Breaking with Plato's and Aristotle's division of the soul into rational and irrational parts, Descartes insists that the human mind, in being a **substance**, is one and undivided, "single and complete" (*ibid.*). "There is within us but one soul and this soul has within it no diversity of parts" (AT XI 364, CSM I 346). Yet Descartes holds that the unity and simplicity of the human mind allows for a variety of "faculties" or powers. Far from being parts of the mind or entities distinct from it, these faculties are different powers, dispositions, or capacities of one and the same mind. As Descartes writes, "the term 'faculty' denotes nothing but a potentiality" (AT VIII B 361, CSM I 305). Descartes believes that it is an error to regard the mind's faculties as its separated parts or as subminds, since neither of them performs the operations of thinking: "It is one and the same mind that wills, and understands and has sensory perception." **Intellect**, will, sense **perception**, **imagination**, and **memory** are all different faculties or potentialities of a single, unified thinking substance (AT VII 86, CSM II 59; cf. AT III 371–72, CSMK 182). Of these faculties, the intellect and the will are purely mental, whereas sense perception, imagination, and memory depend also on the **body**. Descartes accordingly insists that the conflicts usually supposed to obtain between rational and irrational parts or forces of the soul are conflicts between rational volitions originating in the soul and bodily movements, each pushing the **pineal gland** in contrary directions (AT XI 364, CSM I 345). Our failure to properly distinguish the functions of the soul from those of the body leads us to misconceive the different functions of the soul as different subpersons playing opposite roles. However, "it is to the body alone that we should attribute everything that can be observed in us to oppose our reason" (AT XI 365, CSM I 346).

In Descartes' mature philosophy of mind, the two main faculties or powers of the mind are the intellect, which Descartes characterizes as the "faculty of knowledge" (*facultas cognoscendi*), and the will, which is the "faculty of choosing" (*facultas eligendi*) (AT VII 56, CSM II 39). While the intellect (generally considered) is the mind's capacity for evoking and combining ideas, the will "simply consists in our ability to do or not do something (that is, to affirm or deny, to pursue or avoid)" (AT VII 57, CSM II 40). The mental operations that Descartes terms "**thoughts**" are the products of these two faculties when actualized. Descartes divides these modes of thinking into two general categories: perception, or the operation of the intellect; and volition, or the operation of the will. Pure intellect, sensory perception, and imagination are various modes of perceiving, while desire, aversion, and judgment (i.e., assertion, denial, and **doubt**) are various modes of willing (AT VIII A 17, CSM I 204). In the *Passions of the Soul*, Descartes characterizes the will as the mind's activity and the intellect as the mind's passivity. He accordingly distinguishes

between actions and **passions** in our thoughts, depending on whether or not “we experience them as proceeding directly from our soul and as seeming to depend on it alone” (AT XI 342, CSM I 335).

The functional complexity entailed by Descartes’ commitment to faculties may prove a challenge to his conception of the unity of the mind. As his discussion of divine simplicity suggests, it is one thing to argue for the mind’s indivisibility (or lack of parts), and quite another for its simplicity. Descartes famously insists that, in **God**, willing, understanding, and creating are one and the same thing. Any attempt to differentiate between them, or between God and his decrees, is but a distinction of reason, a mere “token procedure of our own reasoning” unfounded in reality (AT V 166, CSMK 348). Descartes accordingly states that “there is always a single identical and perfectly simple act by means of which [God] simultaneously understands, wills and accomplishes everything” (AT VIIIA 14, CSM I 201). Human intellect and will, by contrast, are different mental powers or capacities, each having its own **essence**, function, and scope. To analyze the kind of unity or simplicity that Descartes assigns to the human mind, therefore, we need to determine the metaphysical status of Cartesian faculties or, what amounts to the same thing, the kind of distinction that holds between the mind and its faculties, as well as between the faculties themselves.

A full discussion of the issue will require a careful analysis of Descartes’ theory of **distinction (real, modal, and rational)** – and would take us well beyond the limits of this entry. For our purposes, however, several remarks should suffice. In arguing for the mind’s indivisibility into parts, Descartes clearly commits himself to the view that no *real* distinction obtains between the mind and its faculties or between the faculties themselves (AT VIIIA 28, CSM I 213). But the distinction between the mind and its faculties is not a mere *rational* (conceptual) one either. Had Descartes held that human intellect and will are only rationally distinct from one another and from the mind in which they inhere, he would have agreed that willing and understanding are really identical not only in God but also in the human mind (AT VIIIA 30, CSM I 214–15; Nolan 1997, 137–38). Descartes, however, reserves such perfect simplicity exclusively for God. With regard to us, he appears to assume that a *modal* distinction holds between the mind and its faculties, and between the faculties themselves. Though usually illustrating modes of thinking with examples of various individual thoughts, he sometimes affirms that the faculties of imagination, sensation, and will are various modes of thinking, modally distinct from the mind to which they belong (AT VIIIA 25, CSM I 210–11; AT VII 78, CSM II 54). Seen in this light, the simplicity of the human mind – just like its substantiality – emerges as imperfect in comparison to God’s and is to be found somewhere in between the perfect simplicity of God and the complexity of matter.

See also Distinction (Real, Modal, and Rational), Divisibility, Free Will, God, Imagination, Intellect, Memory, Mind, Passion, Perception, Sensation, Thought

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NOA NAAMAN-ZAUDERER

FAITH, RELIGIOUS

Descartes' thought is characterized by a tension between faith and **reason** with which the philosopher never fully comes to grips. In spite of his many criticisms of the tradition and his endeavor to proceed from entirely new, entirely rational foundations, Descartes appeals in a number of his writings to the importance of faith in human life and the inner compatibility between faith and reason. Nonetheless, as Jacques Maritain (1944, 44) has observed, Descartes' "fundamental principles will develop into a sheer enmity of reason against faith," and Descartes' legacy will eventually become that of a thinker interested exclusively in the earthly project of rendering **human beings** "the masters and possessors of nature" (AT VI 62, CSM I 142f).

Like **Saint Augustine** and **Saint Thomas Aquinas** before him, Descartes proclaims an inner compatibility between religious faith and the principles of his **philosophy**. He asserts his "extreme devotion to the Catholic religion," his "firm faith in the infallibility of the Church," and his conviction that the relation between the truths of faith and the insights of his philosophy are such that he "cannot have any fear that one truth may be in conflict with another" (AT III 259, CSMK 161). Nonetheless, from his earliest writings he seeks to bifurcate the domains of faith and reason along the lines sketched by **Galileo** in his 1615 "Letter to the Grand Duchess Christina" (Galileo 1957): faith concerns matters pertaining to our salvation, whereas reason pertains to earthly questions that can be settled by argumentation and empirical investigation. **Truths** such as the mystery of the Trinity and the **immortality of the soul** are disclosed not by reason but by revelation (AT III 167,

CSMK 166; AT V 53, CSMK 320), whereas metaphysical and scientific questions are to be settled by reason and empirical investigation. One of the principal concerns of Cartesian **metaphysics** is the nature and **existence** of **God**. God plays a key role in Descartes' metaphysics, guaranteeing the truth of clear and distinct ideas; thus natural theology plays a key role in Descartes' thought. But Descartes scrupulously avoids revealed theology, arguing that it lies outside the domain of his immediate philosophical concerns. He criticizes Scholastic attempts to demonstrate truths of faith and dismisses Aquinas's endeavor to develop a rationally grounded angelology (AT V 176, CSMK 350–51; AT V 157, B 19). Descartes' primary philosophical aim is to provide a solid foundation for **physics** and the control over natural forces and processes that it promises to grant to humanity. In the preface to his *Principles of Philosophy*, Descartes offers a tree metaphor that represents the pursuit of human wisdom: the roots are metaphysics, by which Descartes means the nature of God and the human soul, as well as all the clear and distinct ideas that can be possessed by the human **mind**; the trunk is physics; and the branches are all the other sciences, in particular **medicine**, **mechanics**, and morals (see **virtue**) (AT IXB 14, CSM I, 14). Descartes states that “the principal benefit of philosophy depends on those parts of philosophy which can only be learnt last of all,” namely, the disciplines represented by the topmost branches of the tree (AT IXB 15, CSM I 186). He explicitly excludes “divine revelation” from the conception of wisdom that he articulates here, on the grounds that “it does not lead us up by degrees but raises us at a stroke to infallible faith” (AT IXB 5, CSM I 181).

What remains of theology in the foundations of Descartes' philosophy is the rational endeavor to prove the existence of God (by means of two interrelated **cosmological arguments** in the Third Meditation and an **ontological argument** in the Fifth Meditation) and the immortality of the soul. Descartes suggests in the Dedicatory Letter to the Sorbonne (for the *Meditations*) that he has sought to offer rational proof of the immortality of the soul (AT VII 3, CSM II 4). But neither in the *Meditations* nor in any of his other writings does Descartes present such a proof. Instead, he argues simply that the soul and the **body** are metaphysically distinct from one another and that the demise of the body need not entail the demise of the soul; in his later **correspondence** he appeals to the teachings of the faith in concluding that the soul is immortal (AT V 53, CSMK 320).

Descartes' views on theology and religious faith led to two main forms of objection. In his own time, he was charged by some with the sin of **Pelagianism** for having placed such great emphasis on the power of the human will to bring about effects in the world. In antiquity, a dispute had arisen between Saint Augustine and the Pelagians over the question whether salvation is a matter of divine grace or whether human striving could affect our prospects for redemption. In the sixteenth and seventeenth centuries, this controversy became focused in the dispute between the Molinists and the Jansenists, the former arguing for the importance of human

free will and the latter arguing for the Augustinian view that salvation ultimately lies in God's hands and is a matter of predestination (see **Jansenism**). Descartes' rejection of Aristotelianism and his views on the power of the human will placed him, if only against his own intention, in the center of this dispute. Descartes' rejection of Aristotelian **substantial forms** made it incumbent upon him to provide a new account of the phenomenon of **transubstantiation**. The **explanation** that he provided fueled charges of atheism against him, most notably by **Gysbertus Voetius**, the chair of the theology faculty at Utrecht University. Voetius argued that Descartes' philosophy was in conflict with orthodox theology and that it was an inadequate substitute for the Aristotelian philosophy that was then canonical in the Netherlands. The adversity faced by Descartes was augmented in 1646 when **Henricus Regius** published the *Fundamenta Physices*, a text in natural philosophy that Descartes discouraged him from publishing on the grounds that it manifested a complete misunderstanding of the nature and importance of Cartesian metaphysics. Voetius's attacks were so aggressive that Descartes had to appeal to the Prince of Orange to intervene on his behalf.

The other main objection to Descartes' views as they relate to theology and religious faith is the charge of dissimulation: that Descartes was wholly insincere in his appeals to Christian faith and that Christian concepts have no real place in his philosophy. This charge was first lodged by contemporaries of Descartes such as **Henry More**, and it has been repeated ever since. This charge is motivated in part by the unsatisfactoriness of Descartes' proposed explanation of transubstantiation and in part by the fact that Descartes felt sufficiently intimidated by Galileo's having been placed under house arrest for defending the Copernican hypothesis that he suppressed the publication of *The World*, a text in which he had defended Copernicanism (AT VI 60, CSM I 141–42; AT I 270–71, CSMK 40–41). Maritain (1944, 8) considers Descartes to have been “sincerely Catholic,” and Laporte (1950, 465) dismisses the charge of dissimulation as “gratuitous” and “insane.” More recently, Hiram Caton (1973, 12) has maintained that Descartes' appeals to Christian faith and concepts are a “pretense ... made necessary by his understandable desire to avoid persecution for heterodox opinions.” There is no way to determine definitively whether Descartes' appeals to Christian faith and concepts were sincere or not; but in order to support a strong charge of dissimulation against Descartes, one would have to disregard most of Descartes' published texts and correspondence in the matter and in particular would have to disregard the extensive debt to Christian metaphysics that is evident in his writings. Even though “faith does not play any significant role in his philosophical system,” Descartes was a “devoutly religious philosopher” (Cottingham 2008, 270, 256). The subsequent history of natural philosophy was one that decided in favor of secular foundations for the sciences, such that not long after Descartes' time it was no longer considered necessary to ground physics in any sort of natural theology.

See also Calvinism; Cosmological Argument; Free Will; God; Jansenism; Jesuit; Metaphysics; Ontological Argument; Pelagianism; Reason; Regius, Henricus; Soul, Immortality of; Transubstantiation; Voetius, Gysbertus

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GARY STEINER

FALSITY, MATERIAL

Descartes introduces the notion of material falsity in the Third Meditation. An **idea** is materially false, he says, whenever it represents a nonthing as a thing. He contrasts material falsity to another kind of falsity, namely, formal falsity, which, he says, "can occur only in **judgments**" (AT VII 43, CSM II 30). The difference, then, is that whereas material falsity has its origin in *ideation* (or in the faculty of **representation**), specifically in sensory ideas, formal falsity, in being related to judgment, has its origin in the *will*. To help clarify the notion, Descartes offers the example of the

sensory idea of cold. Suppose that one is holding an ice cube in one's hand and that the sensory idea of this ice cube presents cold as a real and positive quality. "If it is true that cold is nothing but the absence of heat [i.e., cold is a privation; so it is nothing at all], the idea which represents it to me as something real and positive deserves to be called false" (AT VII 44; CSM II 30). This kind of falsity is present in the idea even before judgment, and because this is so, it could lead one to judge falsely that the ice cube is cold.

Several related interpretations of the notion of material falsity have emerged in the secondary literature. One interpretation emphasizes Descartes' mention of a *thing* (*res*) in his discussion of the notion, which in this context scholars have interpreted as **substance** (Wilson 1978, Menn 1995). Here, an idea is said to be materially false whenever it represents something that is not a thing or substance as though it were a thing or substance. In the case of the idea of cold, then, the idea is taken to be materially false whenever it represents cold, which is a **mode** (or quality), as though it were a substance. A second interpretation emphasizes the conceptual or logical relation that holds between modes and their principal attributes (Field 1993). On this view, an idea is said to be materially false whenever it represents cold, for example, which strictly speaking is a mode of **mind**, as though it were a mode of **body** or **extension** (in terms of the example, it represents cold to be a mode of the ice cube). Here, the idea "represents" a conceptual or logical impossibility. Related to this is a third interpretation that tells us that given that a contradiction cannot be represented, at best materially false ideas only *appear* to represent, but they in fact do not represent (Hoffman 1996). A fourth interpretation holds that materially false ideas are simply those that provide material for false judgment, not because of their intrinsic representational content as Wilson and others would have it, but because of the way in which the mind habitually confuses its ideas in childhood and then foists those confusions onto the world. The idea of cold, for example, does not intrinsically (mis)represent a quality of bodies; it is only judged to do so (Nelson 1996). A fifth interpretation tells us that an idea is materially false whenever it represents a non-existent thing as though it were an existent thing (Smith 2005a, 2005b).

It is not clear initially how the notion of material falsity fits into Descartes' theory of ideas. One possible role of the notion comes to light in a 1641 letter to **Mersenne**, in which Descartes reveals that a principal aim of the *Meditations* is to undermine Aristotle's (or an Aristotelian) **physics**. Because our ideas of hot, cold, wet, and dry can be shown to be materially false, these very qualities (or our ideas of them) on which Aristotle based his physics are in the end not credible foundations for physics (AT III 297–98, CSMK 172–73). There is something inherently deceptive in our ideas of such qualities.

Although the phrasing "material falsity" appears for the first time in the *Meditations*, the notion (*sans* technical phrasing) looks to be lurking in earlier works. For example, we find a similar analysis of our sensory ideas in *The World*,

written almost a decade before the *Meditations*, in Descartes' discussion of the problematic sensory idea of sound. Here, he claims that the idea of sound fails to provide a "true image" of what the idea in fact represents, namely, the motions of certain air particles: "Thus, if the sense of hearing transmitted to our mind the true image of its object then, instead of making us conceive the sound, it would have to make us conceive the motion of the parts of the air which is then vibrating against our ears" (AT XI 5, CSM I 82). We find a similar analysis of sensory ideas in later works. For example, in *Description of the Human Body*, written roughly eight years after the *Meditations*, Descartes considers the **plenum** as something "filled" with minute balls. He considers cases in which these balls can strike our eyes, causing us to have "sensory awareness of two kinds of motion" (AT XI 255, CSM I 323). The first kind is the rectilinear motion of these balls, the second is their motion as they spin or turn around their centers. "If the speed at which they turn is much smaller than that of their rectilinear motion," he says, "the body from which they come appears *blue* to us; while if the turning speed is much greater than that of their rectilinear motion, the body appears *red* to us" (AT XI 256, CSM I 323). These analyses are compatible with the Third Meditation analysis of the (materially false) sensory idea of cold. This idea is "false" in the sense that it does not present or exhibit to us a "true image" of its **cause**, which in this case would be the motions of particles that constitute the ice cube (which are affecting the motions of the particles of matter that constitute our hand), but instead presents or exhibits to us *cold*, a sensible quality.

Interpreting the notion in the ways suggested here is supported by what Descartes says in other texts, such as the Fourth and the Fifth Replies. **Antoine Arnauld**, author of the Fourth Objections, had pressed Descartes on the notion of material falsity. Arnauld follows Descartes and supposes that cold is the absence (or privation) of heat. Cold, in other words, is taken to be a nonexistent. Traditionally understood, the formal reality of a thing is the kind of reality a thing possesses in virtue of its being an *existent* thing. So, insofar as cold is taken to be a nonexistent, it is taken to lack formal reality. Given that Descartes held that all ideas represent in virtue of their containing objective reality, and that the materially false idea of cold represents cold as a positive quality, it would follow that this idea contains some level of objective reality (see **being, formal versus objective**).

Arnauld's criticism is based on the assumption that the objective reality of an idea must have some cause, an assumption that can be found in the Third Meditation (AT VII 41–42, CSM II 29). It is a principle of representation that emerges in Descartes' introduction of what he calls "primary ideas." In the Third Meditation, Descartes had claimed that although the objective reality of an idea could have its origin in the objective reality of another idea, *ultimately* the objective reality contained in our ideas must have its origin in something that possesses some level of formal reality (AT VII 41, CSM II 29). Such an idea is a primary

idea. The principle of representation is as follows: a primary idea represents X if and only if the objective reality of the idea has its origin in the formal reality of X. The paradigm case of a primary idea is the idea of **God**, which is neither adventitious nor factitious, but *innate*. In terms of the principle, the idea represents God only if the objective reality of the idea has its origin in the formal reality of God. The same holds for the innate ideas of (finite) mind and body (AT VII 79–80, CSM II 55). Descartes in fact will later characterize these three ideas – the ideas of God, (finite) mind, and body – as the *principles* of philosophy (AT IXB 10, CSM I 184).

The materially false idea of cold is a *sensory* idea. Although scholars have counted it among our adventitious ideas, Descartes, at least in one place, says that even sensory ideas are innate (AT VIIIB 359, CSM I 304). If the idea of cold is innate, then it is primary. And here is precisely where the misunderstanding between Arnauld and Descartes begins to surface. As Arnauld seems to argue, if the idea of cold is a primary idea, then according to the preceding principle of representation the idea represents cold if and only if the objective reality of the idea has its origin in the formal reality of cold. But, by hypothesis, cold is taken to be an absence, which is to say that it *lacks* formal reality. If this is so, then if the idea represents cold, the idea will possess some level of objective reality that has no causal origin. Since this is impossible on Descartes' view, Arnauld concludes, "if cold is merely an absence, there cannot ever be a positive idea of it, and hence there cannot be an idea which is materially false" (AT VII 206, CSM II 145).

Arnauld raises this objection in a section titled "Concerning God." Although he never makes it explicit, his criticism of the notion of material falsity suggests the following: if materially false ideas are possible, then an idea can contain objective reality that has no causal origin. In other words, Descartes' view on primary ideas falls apart. But here is the point of concern: if a primary idea can contain objective reality that has no origin, then Descartes must abandon the **cosmological argument** for the **existence** of God in the Third Meditation! For this proof turns on the assumption that there must exist some cause that possesses a level of formal reality that is great enough to account for the level of objective reality contained in the idea. But if an idea can contain objective reality that has no causal origin, as the notion of material falsity seems to allow, then there need not be some cause (in this case God) whose level of formal reality is as great as the objective reality contained in the idea. Since Descartes' epistemology requires the cosmological argument, Arnauld argues that Descartes must in the end abandon the problematic notion of material falsity.

Descartes' reply to Arnauld has been a source of controversy among scholars. Interpretations range from taking Descartes as having been seriously confused about the matter (see, e.g., Kenny 1995, Wilson 1978) to taking him to have had a coherent and even sophisticated view of ideation (see, e.g., Wells 1984; Field 1993; Nelson 1996, 1997; Smith 2005a, 2005b; Wee 2006). Descartes himself claims to have

borrowed the notion of material falsity from **Francisco Suárez**, in the *Metaphysical Disputations*, part IX, section 2, number 4 (AT VII 235, CSM II 164). Even so, it is not clear that Descartes' notion is Suárez's (who discusses the notion of material falsity in connection with words and signifiers, which does not align with Descartes' discussion of the notion in terms of sensation and ideational representation). Problems are compounded when Suárez defends the notion in terms of what would appear to be the Aristotelian doctrine of *material* and *formal* species. But this defense is not available to Descartes, who explicitly rejects it elsewhere (AT VII 387, 437; CSM II 265, 295).

Although Descartes nowhere defines the term "materially" in the body of the *Meditations*, he does later when writing the Preface to the Reader for that work. There he says that an idea taken in the "material" sense is understood as an operation of the **intellect**. This is to understand the idea as an *act* of the intellect. In this case, it is the act or operation of representation. On the other hand, to take an idea "objectively" is to understand the idea as the object represented (or presented) to the mind by way of this act or operation (AT VII 8, CSM II 7). Arguably, the notion of material falsity is tied to this distinction – to the material-objective distinction introduced in the Preface to the Reader (Smith 2005a, 2005b). The view is that something goes awry in respect to the act of representation such that it introduces a representational defect. This defect is what is being referred to as "cold." The idea of "cold," Descartes will say, does not represent *cold*, the mental defect, but represents something else: it represents *motions* (a mode of body), where in a typical case of sensory experience it would represent the motions of the particles that constitute the ice cube one is holding (AT VII 233, CSM II 163). The *cold*, the artifact (or defect), is that by way of which these motions are being represented to the mind. The point is that the objective reality of this idea has its origin in the formal reality of the motions (a mode) of some body.

This view can be gleaned from what Descartes says to Arnauld and **Pierre Gassendi** in the Fourth and Fifth Replies. To Gassendi, he says that the mind-body union and, in particular, the senses "often impede the mind in many of its operations" (AT VII 375, CSM II 258). What is "impeded" is an act or operation of representation. Now, in the Fourth Replies Descartes had said of our sensory idea of cold (i.e., the materially false idea of cold) "that an idea is referred to something other than that of which it is in fact the idea" (AT VII 233, CSM II 163). One suggestion (Smith 2005a, 2005b) is that the *cold*, the sensible quality, may be an artifact of the disturbance, where the one perceiving wrongly takes the idea to represent *it*, the operational disturbance (the *cold*), instead of rightly taking the idea to represent the motions of the particles constituting the ice cube. The true object being represented, the motions of the particles constituting the ice cube, are "obscured" from view, so to speak (Nelson 1996, 1997). This, as noted earlier, would align with his analyses of sensory idea of sound in *The World* and *Description of the Human Body*. Recall that to

take an idea materially is to take it as an act or operation of representation. Insofar as the *cold* has its origin in the disturbed act or operation of representation, and it is this disturbance that accounts for the idea's being "false" (it seems to present cold as its object instead of the motions of the particles constituting the ice cube), we may have Descartes' reasons for calling this kind of falsity *material* falsity. It is a kind of falsity that has its origin in our (sensory) ideas taken materially.

See also Being; Formal versus Objective; Cause; Cosmological Argument; God; Idea; Intellect; Judgment; Representation; Sensation; Truth

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KURT SMITH

FERMAT, PIERRE DE (1607–1665)

Fermat was born in Beaumont-de-Lomagne, son of the wealthy leather merchant Dominique de Fermat and his second wife Claire, née de Long. No records exist of his early education or of his path into **mathematics**. He studied law at the universities of Toulouse and Orléans, where he was awarded the degree of bachelor of civil of law in 1631. In the same year, he married his fourth cousin removed, Louise de Long.

During a sojourn in Bordeaux, at the end of the 1620s, he actively participated in the scientific circle there around Étienne d'Espagnet. Early versions of mathematical texts, including parts of his restoration of Apollonius's *Plane loci*, were circulated among members such as Pierre Prades and **Jean Beaugrand**. After his return to Toulouse, Fermat briefly studied **Galileo's** *Dialogo* and produced work on the topic of free fall.

Fermat's career was in law and civic administration. By the time of his marriage he had purchased the offices of *conseiller* to the Parliament of Toulouse and of commissioner of requests to the palace. In the course of his civic career he reached the highest councils, eventually dividing his time between Toulouse and the court of justice in Castres.

In Toulouse he met **Pierre de Carcavi**, a fellow *conseiller*, who shared his interest in mathematical science. When Carcavi went to Paris to take up the post of royal librarian, he provided a glowing account of Fermat to **Mersenne**. Thus persuaded to initiate a correspondence with the Toulouse mathematician, Mersenne asked Fermat to share his findings with him and other members of his circle.

Relations with Descartes were less equanimous. When Beaugrand, in May 1637, sent galley proofs of the *Dioptrics* to Fermat, the recipient soon reported that the work contained two considerable errors. In particular, the derivation of the sine law of refraction assumed more than Descartes acknowledged. Over the following months arguments were traded, both men being supported by their respective camps: Fermat principally by Beaugrand, Étienne Pascal, and **Roberval**; Descartes principally by **Mydorge**. In November 1637, Roberval and Mersenne solicited Fermat to send his method for determining maxima and minima and tangents to curved lines to them in Paris. Fermat's method, simpler and more general than the method of tangents contained in the *Geometry*, provoked attacks by Descartes not only on Fermat's work but also on him personally. However, in a letter written to Fermat a year later, Descartes appears to concede that that he had been wrong in his earlier assessment (AT II 406).

Partly because of the Fronde, partly on account of an outbreak of the plague, to which he also succumbed, Fermat was largely out of touch with scientific colleagues between 1643 and 1654. During this period he continued to carry out his civic duties and, in his spare time, worked particularly on questions of number theory. After 1654, he conducted a productive correspondence with **Blaise Pascal** on questions of probability.

After 1660, his health deteriorated, owing to lasting effects of the plague. On January 12, 1665, he died at Castres, where he was also buried. His eldest son, Clément-Samuel, edited posthumously his *Varia opera mathematica* (1669) and republished Bachet's edition of Diophantus's *Arithmetica* with his father's famous *Observations* (1670).

See also Beaugrand, Jean; Carcavi, Pierre de; *Dioptrics*; *Geometry*; Light; Mathematics; Mersenne, Marin; Mydorge, Claude; Pascal, Blaise; Roberval, Gilles Personne de

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PHILIP BEELEY

FONSECA, PEDRO DA (1528–1599)

After joining the Society of Jesus, Fonseca studied philosophy at Sanfins and Évora, eventually receiving his doctorate in theology from the University of Évora in 1570. Fonseca taught philosophy at the Colegio das Artes at Coimbra, where he earned the moniker “the Portuguese Aristotle.” He claims to have invented the doctrine of Middle Knowledge while lecturing on divine providence at Coimbra in 1566 (*In Metaph.* III.6.2.4.8). It is probably no coincidence that the famous advocate of Middle Knowledge, Luis de Molina, was a student at Coimbra that year. Fonseca also occupied several ecclesiastical administrative positions (Tavares 1953). As provincial of Portugal he commissioned Emmanuel Goës to publish the famous *Comentarii Collegii Conimbricensis* (Backer, 2:1273) (see **Conimbricenses**). While on administrative assignment in Rome, he contributed to the redaction of the *Ratio Studiorum* (see **Jesuit**).

Descartes may have been familiar with Fonseca’s popular logic textbook, *Institutionum Dialecticarum Libri Octo*, as well as Fonseca’s introduction to Aristotle’s *Categories*, *Isagoge Philosophica*. These works were printed together at La Flèche in 1609, and the former is recommended by name in the *Ratio Studiorum*. Fonseca also wrote commentaries on Aristotle’s *Metaphysics*, but it is hard to say whether Descartes read them.

Fonseca held many of the Aristotelian views against which Descartes reacted, such as a hylomorphic conception of **substance** and the Aristotelian view that “nothing is apprehended by the **intellect** that was not first cognized somehow by the senses” (*In Metaph.* V.2.1–2, I.1.4.3) (Des Chene 1996; Secada 2000, 11–16)

(see **form, substantial**). Fonseca also held versions of the Scholastic doctrines later adopted by Descartes, such as the distinction between formal and objective concepts, which prefigures Descartes' distinction between formal and objective reality, and a version of the modal distinction that would later reach Descartes, in a modified form, by way of **Suárez** (*In Metaph.* IV.2.2.1, V.6.6.2) (see **being, formal versus objective**).

See also Being, Formal versus Objective; Conimbricenses; Form, Substantial; Jesuit; Scholasticism; Suárez, Francisco; Substance

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BRIAN EMBRY

FORCE AND DETERMINATION

Physical force is as puzzling as **Saint Augustine** found time to be. We know what force is if no one asks us, but if we want to explain it to someone, we don't know. We know force as a bodily sensation, and we believe it is implicated in efficient causation; we have ways of measuring it, but we cannot explain its essence. That alone

would account for the absence of a systematic **metaphysics** of force in Descartes' writings, which in turn would account for it being the most intractable problem posed by his **physics**. He never defines force per se, yet he has a concept of **extension** and of **motion** and therefore a conception of physical force expressible as a mathematical **quantity**. Forces are measurable in terms of the same independent variables, which enables Descartes to compare forces of the same category. For the ontological ground of forces he appeals to **God's** continuous creative and conserving activity in the physical world (see **concurrence versus conservation, divine**). It is no surprise that complete agreement among Descartes scholars on the topic of force is in short supply.

Descartes categorizes force in two ways. First, in statics or traditional **mechanics**, the key notion is the force or effort required to raise a **body** against **gravity**, either vertically or along lines inclined to the vertical. The measure of such a force is the product of the body's weight and the vertical distance through which it is raised. It follows that the same force will raise bodies through vertical distances inversely proportional to their weights, a rule that in various forms goes back to antiquity. Descartes' statement of this rule may be called his "General Statical Principle" (GSP) (Gabbey 1993; Slowik 2002, 113–17).

The second category of force applies in domains outside traditional mechanics: collisions between bodies, stones in slings, rigid-body rotation, planetary motion, ballistic phenomena, and free fall under gravity. By the first law of nature, a body in motion has a force to remain in motion; at rest it has a force to remain at rest (see **inertia**). The quantity of motion, given by the speed times the body's volume or corporeal quantity, measures the motive force. The body's "rest force," peculiar to Descartes, is the force with which a body at rest resists any action that would dislodge it from its state of rest. As contrary **modes**, rest and motion cannot coexist in the same body at the same time, so a body at rest and a body colliding with it are in causal opposition. Were there no such opposition, the total quantity of motion would be distributed between the two bodies with final speeds inversely to their sizes. But the body at rest resists the reception of its would-be final speed with a force measured by its volume times the would-be final speed, that is, by its would-be proportionate quantity of motion. This resisting force acts on the other body already acting on the body at rest with *its* proportionate share of motive force. The stronger of the two contesting forces prevails, thereby determining the outcome of the collision. Whether the body initially at rest remains at rest or is set in motion, the total quantity of motion of both bodies is conserved throughout (see *Principles of Philosophy* II.37–38, 40–44). On rest-force and related contentious issues in Descartes' laws of collision, see Gabbey 1980, 266–72; Garber 1992, 234–53; Des Chene 1996, ch. 8, and 2000; Hattab 2000; Schmaltz 2008, 96–99.

Though Descartes gives no formal comparative exposition of these two categories of force, he brings them into mathematical relation in the letter to **Mersenne** of September 12, 1638, where the issue is the number of “dimensions” (variables) needed to measure a body’s force. The measures of static and motive force depend on whether one dimension (weight), two dimensions (weight and vertical distance), or three dimensions (weight or corporeal quantity, distance, and speed) are involved (AT II 352–55). The distinction between one- and two-dimensional force (weight and static force) and three-dimensional force (motive force) mirrors the distinction between traditional mechanics and the new science of motion of which Descartes was a principal protagonist. In statics or traditional mechanics, speeds are of little interest. In the new science of motion (laws of collision, circular motion, ballistics, celestial mechanics), the speeds of bodies, and their determinations (discussed later in this entry), are as important as their sizes. This disciplinary distinction is the source of significant problems (see **mechanics**).

Descartes rarely talks about the transmission of force in bodily interactions. A body has a force to move or remain at rest, but in a collision with another body it is usually a quantity of *motion* or a degree of *speed* that is or is not transferred between the bodies. In *The World*, the second law of nature states that “when a body pushes another, it could not give it any motion that it does not at the same time lose as much of its own, nor could it remove from it any that its own does not increase by as much” (AT XI 41). In the *Principles of Philosophy* II.40, the Third Law of Nature states that “when a moving body meets another, if it has less force to continue to move in a straight line than the other has to resist it, it is deflected in the other direction, retaining its quantity of motion and changing only the determination of that motion. However, if it has more force, it moves the other body with it, and loses as much of its motion as it gives to the other body” (AT VIII A 65, CSM I242). In the Rules of Collision (*Principles* II.46–52), the relative sizes of the motive or rest forces determine the outcome of the collisions, but it is not forces that are said to be exchanged but speeds or quantities of motion.

It is likely that this way of describing bodily interactions derives from Descartes’ doctrine that the world exists only because God maintains it in **existence** after the Creation through his sustaining power (see **concurrence versus conservation, divine**). The primary **essence** of body is **extension** and nothing else, quite independently of whether any bodies actually exist. But for a body to exist physically (as distinct from existing objectively in the **mind**) requires God’s concurrent sustaining power, expressed as a force dependent on the body’s size, motion, or rest, and on the requirements of the relevant law of nature or rule of collision (see further Gueroult 1980). Scholars disagree about whether God’s sustaining power takes the form of a re-creation of the world at each successive instant, or of a continuous sustenance through time (Garber 1992, 266–73). At any rate, physical forces express the divine power that maintains bodies in existence, whatever their modal state. In the Fifth

Replies, Descartes reminds **Gassendi** of a fundamental distinction between **causes** “with respect to becoming” (*secundum fieri*) and causes “with respect to existence” (*secundum esse*) (AT VII 369–70, CSM II 254–55). The forces of motion and of rest, which express God’s maintenance of bodies *simply in existence* in their respective modal states, are causes *secundum esse*. However, as the causes of *modal changes* in the corporeal world, together with determination, they are *causa secundum fieri*, “the secondary and particular causes of the different motions we see in individual bodies,” which Descartes identifies with the three **laws of nature** (AT VIIIA 62, CSM I 240). The problem is to disentangle what this identification amounts to (see Des Chene 2000 and Hattab 2000).

Force as *causa secundum esse* can be understood as an **attribute** of body. The distinctions between attribute, mode, and quality are not crystal clear in Descartes, but it is beyond doubt that existence and duration are not modes. As he writes in *Principles* I.56, “in created things, whatever is never in them in a changeable way [*diverso modo*], such as existence and duration in the existing and enduring thing, ought to be called attributes, not qualities or modes” (AT VIIIA 26, CSM I 211–12). As Descartes goes on to argue in I.62 (*On the distinction of reason*), “if any substance ceases to endure, it also ceases to be, so it is just by reason that it is distinguished from its duration” (AT VIIIA 30, CSM 214). In other words, the duration of an existing body does not admit of intensive degrees: either it is existing or it is not. Force as *causa secundum esse* is a *secondary* attribute of existing bodies because it “is never in them in a changeable way,” though the force as *causa secundum fieri* will vary with their size, speed, and determination. Extension remains the *principal* attribute of body, because a body is a *res extensa*, whether it exists objectively in the mind or as part of the physical world (see Garber 1992, 293–99; Slowik 2002, 57–59; Schmaltz 2008, 116–21).

Descartes’ concept of “determination” (*determinatio*, *détermination*) plays an important role in his natural philosophy. In classical Latin, and later in Scholastic texts, *determinare* and its cognates denoted a bounding within spatial or temporal limits. For Aquinas, *determinatio*, a specified actualization of a general power, “is the first principle of plurality.” Though evidently not a neologism in Descartes, *determinatio* seems not to have been used in natural philosophy before *The World* (ca. 1630), about the time *Dioptrics* was taking shape. In chapter 2 of *The World*, Descartes notes “that the power to move and that which determines the direction in which the motion must take place, are two quite different things and can exist one without the other (as I have explained in the *Dioptrics*)” (AT XI 8–9, CSM I 83–84). Because of its dependence on speed, determination is quantifiable and is a mode of motion: “There are in motion two different modes: one is the motion alone, or the speed, and the other is the determination of this motion in a certain direction. Of these two modes, one changes with as much difficulty as the other” (AT IV 185, CSMK 247). Descartes’ determination is a directional aspect of motion or motive

force and, together with speed, is a principle of diversification in Descartes' physical world. It may be defined as the directional mode of motive force. This **definition** accords with his almost tautological explanation of the concept: "In speaking of the determination towards the right, I mean all that part of the motion that is determined towards the right" (AT III 251).

It is important to note that determination is not direction itself, as some have assumed. In 1648 Mersenne asked Descartes to comment on a treatise of **Roberval's** on kinematical methods in finding tangents. Descartes' reply begins:

I read only the first 15 pages of the piece you wanted me to see, because it is only as far as there you said mention was made of me. But I confess I admired those pages, in that I found nothing in them that was not false except what has been lifted from my writings; and the author shows he has lifted things, because he uses my own words to express them. And if he changes some of them, as when he calls impression what I call speed, and direction what I call the determination to move in a certain direction, that only serves to confuse him. (AT V 203)

Unaccountably, some Descartes scholars today are as confused as Roberval was about the distinction between direction and determination.

Descartes applies his concept of determination in his collision theory, in his analysis of circular motion and in the **vortex** theory, and more strikingly in his demonstrations and applications of the laws of reflection and refraction (AT VI 93–105, CSM I 156–64). For further details on the concept of determination and its deployment in Descartes' physics, see Sabra 1967, chs. 1–4; Gabbey 1980, 248–61, Garber 1992, 188–93; Des Chene 1996, 309–11; McLaughlin 2000; Schuster 2000, secs. 1–3.

See also Attribute; Conservation of Motion, Principle of; Inertia; Law of Nature; Light; Mechanics; Motion; Optics; Physics; Quantity; Roberval, Gilles Personne de; Vortex

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ALAN GABBEY

FORM, SUBSTANTIAL

The notion of substantial form was central to Aristotelian **Scholasticism** mainly on two accounts relevant to Descartes. First, natural **substances** are composites of prime matter and one substantial form (or more forms, depending on the Scholastic). This view was central to the Aristotelian distinction between substantial and accidental change. A substance such as a cow comes into being as a result of a form being "educted from matter," a natural process. The cow's death consists in the demise of a substance and the separation of matter and form. In the case of "accidental" change (e.g., the cow puts on weight), the substance remains, but its accidents (its qualities, other states not part of its essence) change (Adams 1987, ch. 15). Second, the Scholastics argued that a substance must have a substantial form in which its characteristic qualities and behavior are rooted and united. The form constitutes the nature or essence of the substance, and it explains why humans laugh, horses neigh, and water cools down when removed from a source of heat (Suárez, *Disputationes metaphysicae*, XV.1). Substantial forms must be distinguished from **real qualities**, which are accidents.

Descartes held instead that all phenomena in the physical world should be explained mechanistically in terms of qualities that are **modes of extension**. He often remains studiously quiet about substantial forms, and this was part of a strategy. He thought it imprudent to reject them explicitly (AT VI 239; AT II 199–200, CSMK 107) and assumed that offering his own mechanistic system would automatically lead to an abandonment of substantial forms (AT III 500, CSMK 207). As he explains to **Mersenne**,

I will tell you, between you and me, that these six Meditations contain all the foundations of my **Physics**. But please do not say so; for those who favor Aristotle would perhaps cause more trouble for their approval. And I hope that those who read them, will get used to my principles without noticing and recognize their **truth** before realizing that they destroy those of Aristotle (AT III 297–98, CSMK 173)

He also contends that the notion of substantial form is obscure (AT III 506–7, CSMK 208–9), involves a confusion of the mental and the physical (AT VII 443, CSM II 298), and is useless for the purpose of **explanation** (AT VIIIB 26, CSMK 221).

Descartes never explicitly argues against the other role of substantial form, as metaphysical constituent of a composite substance, but his conception of substance rules it out. He describes substances as “things that must be created by **God** in order to exist” (AT VII 14, CSM II 10) and couples this view with a rejection of the possibility of substantial forms coming about by being educed from matter (AT III 505, CSMK 208). So the implication is that substances cannot be Aristotelian composites of matter and form that come to be through natural processes. All natural change will be a change in qualities, that is, in modes (Rozemond 1998).

But Descartes’ objections to substantial forms specifically concern their employment in the physical world (AT III 502, CSMK 207). He claims that the human soul is a substantial form, the only one (AT VII 356, CSM II 246; AT III 503, 505, CSMK 207–8; AT IV 346, CSMK 279). This has led to the interpretation that for Descartes the mind-body composite is a genuine substance and that his solution to the problem of the union of **mind** and **body** is that the mind is the form of the body (Hoffman 1986) (see **human being**).

There are, however, serious philosophical problems with this approach (Rozemond 1998, ch. 5). Furthermore, Descartes never called the mind-body composite a substance, and he never offers the idea that the soul is the form of the body as a solution to the problem of the union. Instead, he connects its status as a substantial form to its immortality (see **soul, immortality of the**). But this conception of the soul strains against its status as a substantial form in the original Aristotelian

sense as inherently a constituent of a substance rather than separable, and against the unity of the human being. In Aristotelian **Scholasticism**, the human soul was a unique substantial form in that it was also regarded as a spiritual substance, an entity that can by its nature exist without the body. But this aspect of the human soul was seen as in tension with its status as a substantial form (Aquinas, *Summa Theologica* I.76.1).

Understanding of Descartes' calling the mind a substantial form benefits from consideration of a pronouncement of the Council of Lateran of 1513 that the human soul must be regarded as the substantial form of the human body. The council was addressing the Averroist position that there is only one rational soul for the entire human species and that the rational soul is not the form of the body. This position implied that humans are not individually immortal, since immortality pertained to the rational soul only. So the council's concern was not with the unity of the human being but with personal immortality and the **individuation** of the human soul. A consequence of this pronouncement may have been a reluctance in early modern thinkers to abandon the term "substantial form" for the human soul even when they were not hylomorphists.

See also Body; Dualism; Human Being; Mind; Quality, Real; Scholasticism; Soul, Immortality of the; Substance

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MARLEEN ROZEMOND

FOUCHER, SIMON (1644–1696)

Born in Dijon and educated at the **Jesuit** college of Dijon, Foucher joined the order, then left for Paris, where he attended the courses of the Faculty of Theology at the

Sorbonne. He was in contact with **Jacques Rohault** and took part in the meetings of the latter's circle, where he criticized Descartes' **philosophy** from a skeptical vantage point. He made **experiments** in hygrometry, of which he published several accounts. He engaged in a long polemic with **Malebranche** and Rohault. During **Leibniz's** visit to Paris from 1672 to 1676, Foucher was introduced to him; a long correspondence between the two men followed, as well as the publication, under Foucher's care, of some of Leibniz's writings in the *Mémoires de l'Académie des Sciences* and the *Journal des Sçavans*. He died in 1696, while writing a second critique of Leibniz's theory of monads.

In the *Critique de la Recherche de la vérité*, Foucher takes aim at Descartes for having affirmed the simplicity of the soul and the existence of necessary truths outside **mathematics** and theology. One cannot identify necessary truths in **physics**, **medicine**, and morals, since individuals are subject to change and their **essences** could be "but **ideas**." Foucher criticizes Descartes' theory of the creation of **eternal truths** from several perspectives. From the point of view of the liberty of **God**, he thinks that it is by grace, not nature, that God preserves the immutable **truths**. On the other hand, in terms of the principle of noncontradiction, he questions God's liberty to change the eternal truths. As for proving the necessity of the eternal truths by means of the immutability of God's will, Foucher affirms that this is "proving too much," since the immutability might concern all creatures and thus block all of the changes in the world. On the other hand, if one were to maintain after all, in view of the free determination of God's will, that these truths are necessary by their nature and that this necessity derives from the immutability of the divine will, then one would need to suppose one possessed "the science of the **existence** of God, of his will, of his liberty and of his power," which is to trespass on the domain of faith.

As for the possibility of **knowledge** in general, Foucher exhibits similar skepticism. With respect to the three faculties of man, that is, the senses (see **sensation**), the **imagination**, and the pure understanding, Foucher denies them in turn the capacity for adequate knowledge. On the subject of the theory of ideas and, in particular, of their manner of representing things, Foucher maintains, with Descartes, that "the idea is what the mind perceives immediately" and infers that all ideas are but ways of being of our soul. It will thus be difficult to maintain that we have "two sorts of ideas," that is, "ideas that represent unto us what is outside us and ideas that only represent what is inside us," since we would have to distinguish between the respective "ways of being of our souls." Neither do our senses give us knowledge of things outside us, since, in view of the mutually exclusive **definition** of **substances**, there is nothing in the objects that is similar to what they produce in us. A dilemma follows, according to which "either all our ideas represent unto us material objects, or we have none that is capable of representing them." For Descartes, it would therefore

not be necessary that the ideas should be similar to the objects in order to be able to represent them. From there on, Foucher develops a critique of the **representation** of ideas.

Another objection has to do with the **certainty** of the existence of matter outside us. Indeed, if **extension** is made known only by our senses, and therefore a “way of being” of our own soul, how can we know that there is something similar to it in material objects? Our representation of it means either that our soul is extended or that there is no point-to-point correspondence between the objects and the soul. In other words, either the soul has a material foundation, or there is no way to secure the certainty of the knowledge of material objects *a parte rei*, perhaps not even that of their existence.

With these objections, Foucher developed a line of criticism that had been initiated primarily by **Gassendi** in the Fifth Objections, which attacked the coherence of Cartesian **dualism** in view of the absence of a third category, mediating between **mind** and **body**, which could explain their interaction. Foucher’s arguments were later developed by **Pierre-Daniel Huet** and **Jean Du Hamel**, mentioned by **Pierre Bayle** in his *Dictionnaire*, and subsequently read by Berkeley and Hume.

See also Eternal Truth; Jesuit; Knowledge; Representation; Rohault, Jacques

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FREE WILL

Contemporary philosophical work on freedom standardly refers to the topic as “free will,” even though in present-day philosophy relatively little attention is given to the will. This was not the case in the early modern period in general or in Descartes’ writings in particular. Descartes explains freedom in terms of the will. Yet Descartes never uses the Latin words properly rendered as “free will” and “freedom of the will” and only rarely uses the French words so rendered, instead referring primarily to freedom, as will be done in what follows as well.

1. DIVINE AND HUMAN FREEDOM

Descartes treats the topics of divine and human freedom both in completed works and in letters, but he devotes considerably more attention to human freedom, which may reflect his desire to avoid theological controversy as much as possible (AT IV 117, CSMK 234). He also maintains in the Sixth Replies that “the way in which [freedom] exists in **God** is quite different from the way it exists in us.” He believes that God’s will is indifferent to all objects – that is, there is no rational basis for God to will one thing rather than another (AT VII 431, CSM II 291). This indifference, Descartes claims, reflects God’s power: “The supreme indifference to be found in God is the supreme indication of His omnipotence” (AT VII 432, CSM II 292). “But as for man,” Descartes writes,

since he finds that the nature of all goodness and **truth** is already determined by God, and his will cannot tend towards anything else, it is evident that he will embrace what is good and true all the more willingly, and hence more freely, in proportion as he sees it more clearly. He is never indifferent except when he does not know which of the two alternatives is the better or truer, or at least when he does not see this clearly enough to rule out any possible doubt. (AT VII 432–33, CSM II 292)

In this passage, Descartes repeats the account of indifference articulated in his treatment of **judgment** in the *Meditations* (AT VII 58–59, CSM II 40–41).

Although divine and human freedom thus seem to differ considerably, in the *Meditations* Descartes nevertheless says that

it is above all in virtue of the will that I understand myself to bear in some way the image and likeness of God. For although God’s will is incomparably greater than mine, both in virtue of the **knowledge** and power that accompany it and make it more firm and efficacious, and also in virtue of its

object, in that it ranges over a greater number of items, nevertheless it does not seem any greater than mine when considered in an essential and strict sense. (AT VII 57, CSM II 40)

Despite the differences in power and knowledge between **human beings** and God that reflect the differences between finite human beings and the infinite God, the human **faculty** of the will, “when considered in an essential and strict sense” – hence apart from its efficaciousness and its objects – is nevertheless akin to that of God. In the *Principles*, Descartes seems to go further, saying that the will “can in a certain sense be called infinite, since we observe without exception that its scope extends to anything that can be possibly an object of any other will – even the immeasurable will of God” (AT VIIIA 18, CSM I 204).

The scope of the will, Descartes maintains in both the *Meditations* and the *Principles*, is at least part of the reason that human beings make errors in judgment: because the human will extends to all possible objects of cognition, it is possible for human beings to misuse their wills and err (AT VII 58, CSM II 40–41; AT VIIIA 19, CSM I 205). Error is a misuse of free decision (*liberum arbitrium*) (AT VII 60, CSM II 41), “a defect in the way that we act or in the use we make of our freedom” (AT VIIIA 19, CSM I 205) (see **error, theodicies of**).

In his published works, Descartes consistently maintains that human beings are free. In the Third Replies, he writes that “our freedom is very evident by the natural light” (AT VII 191, CSM II 134). In the *Principles*, he says “that there is freedom in our will ... is so evident that it must be counted among the first and most common notions that are innate in us” (AT VIIIA 19, CSM I 205–6). And in the *Passions of the Soul*, Descartes says that “the will is by its nature so free that it can never be constrained” (AT XI 359, CSM I 343). In all these works – and hence throughout his mature philosophical work – Descartes thinks that it is evident that human beings are free. The nature of this freedom, however, has not proved to be so evident to commentators.

There is considerable scholarly debate about whether Descartes’ claims about human freedom cohere, especially when comparing those in the *Meditations* with those in the *Principles* and in a couple of letters treating the **Jesuit** (Molinist) conception of freedom (AT IV 115–17, CSMK 233–35; AT IV 173–75, CSMK 246–47). It has been maintained that Descartes has no settled conception of human freedom (Gilson 1913) and that he changes his conception of freedom in the course of his philosophical career (Alquié 1950, Schmaltz 2008, Beyssade 1994). Even those commentators who maintain that a settled conception of human freedom is to be found in Descartes’ mature work disagree about whether that conception is compatibilist (Chappell 1994), incompatibilist (Ragland 2006b), or necessitarian (Cunning 2010) or whether the coherence is to be located in some other dimension (Bouchilloux 2004).

In order to assess these diachronic claims about Descartes' account of human freedom, it is necessary to have a sense of the conceptions of freedom developed in each of the works at issue. Since there is controversy about the interpretation of the account of freedom in individual works themselves, in what follows each work is treated in turn, and the interpretive debates that arise concerning those works and their relation to other works, especially the *Meditations*, are outlined; the question of the nature and coherence of Descartes' conception of freedom is engaged in the conclusion of this entry.

2. THE *MEDITATIONS*

Scholarly debate about the account of human freedom in the *Meditations* has centered on Descartes' **definition** in the Fourth Meditation of "the will, or freedom of decision" (*voluntas, sive liberum arbitrium*), which, he says,

consists only in this, that we are able either to do or not to do (that is, to affirm or deny, to pursue or avoid), or rather [*vel potius*], only in this, that to that which is proposed to us by the **intellect** for affirming or denying, or pursuing or fleeing, we are so borne that we feel ourselves to be determined by no external force. (AT VII 57, CSM II 40)

(The focus here is on the Latin edition of the *Meditations*; Beyssade 1994 claims that the 1647 French edition of the *Meditations* reflects a change in Descartes' conception of freedom that also emerges in letters regarding the Jesuit account of freedom. This issue is bracketed in what follows in the context of the *Meditations*, since the conceptual issue is engaged in treating the letters.) Kenny (1972) claims that the first clause corresponds to freedom of indifference, according to which it is in the agent's power to make or not to make some choice, while the second clause corresponds to freedom of spontaneity, according to which the agent chooses what she wants. Following Kenny, commentators – especially Anglo-American commentators – have sought to determine which of these distinct and incompatible conceptions of freedom is to be attributed to Descartes. This question would seem to bear directly on whether Descartes endorses a compatibilist or incompatibilist conception of freedom in the *Meditations*. If Descartes is committed to freedom of indifference, this would seem to imply that he is an incompatibilist; if Descartes is committed to freedom of spontaneity, this would seem to imply that he is a compatibilist. (French commentators have not been interested in this aspect of the interpretive debate.) Interpreters have focused in this context on the signification of the expression *vel potius* that links the two clauses of the definition.

It has been argued that *vel potius* signals a clarification, perhaps limiting the scope of the first clause (Ragland 2006a); a retraction of the first clause (Kenny 1972); or an equivalence between the clauses (Schmaltz 2008). Ragland (2006a) takes the fact that Descartes uses both clauses to count in favor of a clarification, as well as the fact that the definition is meant to explain the respect in which human beings are in the image of God (AT VII 57, CSM II 40), arguing that, given, as we have seen, divine freedom consists in indifference, human freedom must do so as well. Kenny (1972) gives as reasons for a retraction the fact that Descartes thinks that when an agent has a clear and distinct *idea* she cannot but assent to it (AT VII 58–59, CSM II 41), so she cannot be indifferent to clear and distinct ideas, and is only spontaneous with respect to them (see **clarity and distinctness**). By contrast, agents must be able to refrain from assenting to confused and obscure ideas, so they must be both indifferent and spontaneous with respect to them. On this view, Descartes thinks that human freedom always consists in spontaneity, but that it sometimes also consists in indifference. Given, however, that elsewhere in the *Meditations*, Descartes uses the expression *vel potius* to signal the introduction of a preferred expression (AT VII 59, CSM II 41; AT VII 190, CSM II 134; AT VII 251, CSM II 175; AT VII 444, CSM II 297), but not to indicate a semantic difference between the expressions in question, there is lexical basis for thinking that an equivalence is correct.

It seems unlikely that anything follows from this passage about the nature of Descartes' account of freedom, however, for the definition in the Fourth Meditation is not a definition of freedom, but of the *will*, and it is therefore a mistake to center the interpretation of Descartes' account of freedom in the *Meditations* on this definition. To be sure, Descartes does identify the will and freedom of decision (AT VII 56–58, CSM II 39–40), and this would seem to imply that all acts of the will – all judgments – are free. If this is correct, however, the proper understanding of the definition is orthogonal to the question of whether Descartes is a compatibilist or an incompatibilist about human freedom, which centers on the question of whether free choices are determined. That said, there remain questions about how the two clauses of the definition fit together, and why – if this is indeed the case – Descartes prefers the second clause to the first.

Even if it is correct that Descartes' identification of the will and freedom of decision implies that all acts of the will are free, this does not close the topic of his conception of freedom in the *Meditations*, for there he uses the word “freedom” (*libertas*) to refer to an altogether different sense of freedom from that at issue in the debate about whether he is a compatibilist or incompatibilist. Descartes distinguishes grades of freedom, ranging from highest, when an agent assents to a clear and distinct idea, to lowest, when “there is no reason pushing me in one direction or other” (AT VII 58, CSM II 40). On this account, agents are indifferent whenever they do not have clear and distinct ideas, and freedom varies directly with the clarity

and distinctness of **perceptions** (Gilbert 2005). This scalar conception of freedom is not standardly at issue when one considers the question of whether a philosopher is a compatibilist or an incompatibilist, although it may ultimately bear on the topic.

The question arises how Descartes' scalar conception of freedom fits together with his conception of the will. Because Descartes thinks that there are degrees of freedom, it follows that there must be a univocal notion of the will that applies when agents perceive clear and distinct ideas and when they have anything less than a clear and distinct perception. Since agents cannot but assent to clear and distinct ideas, while their assent to confused and obscure ideas is in their power, the will must be a power of choice that is under an agent's control.

3. PRINCIPLES OF PHILOSOPHY

In the *Principles*, Descartes treats freedom in relation to judgment (as in the *Meditations*), as well as the relation between divine providence and human freedom. His handling of both of these topics seems to yield different accounts of freedom from that given in the *Meditations* and has been taken to lend support to the view that he is an incompatibilist (Ragland 2005, 2006b; Schmaltz 2008).

a. Judgment

There seems to be a tension in Descartes' account in the *Principles* of the relation between freedom and judgment. On the one hand, he says that "the **minds** of all of us have been so molded by nature that whenever we perceive something clearly, we spontaneously give our assent to it and are quite unable to doubt its truth" (AT VIIIA 21, CSM I 207). Here Descartes seems to reiterate the position of the *Meditations* that agents cannot but assent to clear and distinct perceptions. Yet a few articles earlier in the *Principles* Descartes seems to suggest otherwise, explaining that freedom distinguishes human beings from **automata**: the latter act necessarily, but the former act freely, and, Descartes explains, "our doing so ... is much more to our credit than would be the case if we could not do otherwise" (AT VIIIA 19, CSM I 205). At first blush, this passage might seem to suggest that agents are indeed able to withhold assent from clear and distinct perceptions. After careful consideration, however, this passage can be seen as merely marking the difference between beings that are necessitated in their actions and agents who have wills and can therefore determine themselves instead of being determined by external forces.

A further *prima facie* difference between the *Principles* and the *Meditations* is that whereas in the latter Descartes treats indifference as a defect (AT VII 58, CSM

II 40), in the former he seems to identify freedom and indifference (AT VIIIA 20, CSM I 206). Kaufman (2003) takes this identification to constitute an extension of the characterization of divine freedom to humans. Schmaltz (2008) urges, however, that since Descartes says that “the minds of all of us have been so moulded by nature that whenever we perceive something clearly, we spontaneously give our assent to it and cannot doubt its truth” (AT VIIIA 21, CSM I 207), this use of “indifference” should not be taken to indicate any substantive change in Descartes’ position from the *Meditations*.

b. Divine Providence

Descartes acknowledges that human freedom and divine providence – including foreknowledge and determination of all events – seem to conflict: “We can easily get ourselves into great difficulties if we attempt to reconcile this divine preordination with our freedom of the will, or attempt to grasp both these things at once” (AT VIIIA 20, CSM I 206). We can get into such great difficulties because “we cannot show how [God’s power] leaves the free actions of men undetermined” (AT VIIIA 20, CSM I 206). These remarks suggest that while Descartes is committed to both divine providence and human freedom, he has no account of how they are to be reconciled. The reference to indeterminacy has, however, suggested to some commentators (Ragland 2005, Schmaltz 2008) that Descartes is here endorsing, or at least verging on, an incompatibilist account of freedom. This is, admittedly, a natural reading of the passage. It is, however, possible that in this passage, as in the passage about automata from earlier in the *Principles*, the worry about determination is that the divine providence necessitates actions, so that they are no longer voluntary (and hence free, given that Descartes takes there to be no distinction between the voluntary and the free). On this reading, the passages about divine providence do not manifest a commitment to libertarianism.

4. JESUIT LETTERS

Two letters – the first of May 2, 1644, known to be addressed to the Jesuit **Denis Mesland**, the second of February 9, 1645, standardly taken to be addressed also to Mesland – have been taken by certain commentators (Alquié 1950, Schmaltz 2008) to reveal a further change in Descartes’ conception of human freedom and by others to manifest his considered position on the topic (Ragland 2006b). The second letter, in particular, has been taken as a star text for the interpretation of Descartes’ account of human freedom.

a. Letter of May 2, 1644

This text, which opens by alluding to what are presumably remarks by Mesland regarding an apparent similarity between Descartes' views and those of the Jesuit **Denis Petau**, is broadly consistent with the position in the *Meditations* and the *Principles* regarding the relation between will and judgment (Schmaltz 2008). Descartes reaffirms the account of indifference advanced in the *Meditations*, according to which indifference varies inversely with the clarity and distinctness of an agent's cognition (AT IV 115, CSMK 233) and is not essential to human freedom (AT IV 116, CSMK 234). He also claims, what is central to the treatment of human freedom in the *Meditations*, that "a great light in the intellect is followed by a great inclination in the will" (AT IV 116, CSMK 233). He also reaffirms the identity of the voluntary and the free (AT IV 116, CSMK 234). Descartes emphasizes the fact that suspension of judgment – a concept only alluded to in passing in the *Principles* (AT VIIIA 6, CSM I 194), although central to the *Meditations* – arises on account of the nature of the human mind:

But the nature of the soul is such that it hardly attends for more than a moment to a single thing; hence, as soon as our attention turns from the reasons which show us that a thing is good for us, and we merely keep in our **memory** the thought that it appeared desirable to us, we can call up before our mind some other reason to make us doubt it, and so suspend our judgment, and perhaps even form a contrary judgment. (AT IV 116, CSMK 233–34)

Schmaltz (2008) claims that this passage marks a shift from the position of the *Meditations*, insofar as it suggests that assent to clear and distinct perception requires an effort of will and does not merely depend on the perception. But Descartes recognizes this "weakness" (AT VII 62, CSM II 43) in the *Meditations*; moreover, Descartes need not be taken to imply that attention is determined by the will, for it may be determined by the clarity and distinctness of cognition, as Descartes implies in the *Meditations* (AT VII 62, CSM II 43). If this interpretation is correct, then the texts would be consistent.

b. Letter of February 9, 1645

This letter has been the focus of scholarly attention because it seems to manifest a profound shift from the position of the *Meditations*, and hence to mark a final stage in the evolution of Descartes' conception of human freedom. Before turning to the content of the text, it should be noted that there is controversy regarding the text itself. (For a fuller discussion of the complicated provenance of the letter, see

Lennon 2013.) The text is presented in AT as a continuation of a letter of February 9 to Mesland, which is somewhat implausible given that the text in question is written in Latin whereas the remainder of the letter is written in French, and it is unlikely that Descartes should have switched languages halfway through the letter. The fact that there is some overlap between the content of this text and the letter of April 2, 1644, has been taken as evidence that the letter was written around the same time, and that it, too, was an attempt to accommodate the Jesuit (Molinist) conception of freedom, according to which indifference is essential to human freedom (Schmaltz 2008). This conception of the text underwrites the significance assigned to it by most commentators.

Descartes begins the letter by reaffirming the conception of indifference advanced in the *Meditations* (AT IV 173, CSMK 245). He goes on, however, to say that

perhaps others mean by “indifference” a positive **faculty** of determining oneself to one or other of two contraries.... I do not deny that the will has this positive faculty. Indeed, I think it has it not only with respect to those actions to which it is not pushed by any evident reasons ... but also with respect to all other actions; so that when a very evident reason moves us in one direction, although morally speaking we can hardly move in the contrary direction, absolutely speaking we can. For it is always open to us to hold back from pursuing a clearly known good, or from admitting a clearly perceived truth, provided we consider it a good thing to demonstrate the freedom of our will by so doing. (AT IV 173, CSMK 245)

This passage is usually taken to manifest a break from the *Meditations* and to consolidate the identification of freedom and indifference in the *Principles*, insofar as Descartes here seems to be denying that a great light in the intellect is followed by a great inclination in the will, and to maintain that agents can “absolutely speaking” resist the determination of the will by clear and distinct perceptions. The extent of the break from the position of the *Meditations* can, however, be called into question. Insofar as in both the letter of April 2, 1644, and the *Meditations* Descartes admits that the mind may fail to attend to clear and distinct perceptions, he may be drawing attention to this phenomenon in the cited passage as well, from which it might be concluded that there is less of a distance between the fragment and the *Meditations* than most commentators have taken there to be.

Thomas Lennon (2013) has argued that the text should be seen as a response to the views of Denis Petau, alluded to in the beginning of the treatment of freedom in the letter of April 2, 1644, and that it is not a letter but rather a “memorandum” regarding Petau’s views that Descartes wrote for his own use. According to Lennon, Petau does not mean to endorse the Jesuit (Molinist) conception of freedom, and is

indeed neutral between the Molinist view and the alternative, Thomist view of freedom. Given that Petau's views are consistent with those expressed by Descartes in the *Meditations*, in expressing his "complete agreement" with Petau Descartes should not be seen as revising the conception of freedom advanced in the *Meditations*.

5. DESCARTES' CONCEPTION OF HUMAN FREEDOM

Scholarly controversy regarding Descartes' conception of human freedom has arisen from his apparently conflicting claims about the topic made at various points in his career. We have seen that while there is some *prima facie* basis for taking Descartes' views to have changed over time, the post-*Meditations* texts – especially the late letters – can be read in such a way as not to entail any change from the position expressed in the *Meditations*.

So where does this leave the debate – predominantly among English-language commentators – about whether Descartes is a compatibilist or incompatibilist (libertarian) about human freedom? If one takes Descartes to be working in the present-day problem space, it would seem to follow that he is a compatibilist. However, there is reason to be suspicious of the idea that Descartes was interested in the putative threat of determinism. Nowhere in his writings does Descartes consider the relation between human freedom and causal determinism. He also does not explicitly address the closely related and structurally analogous topics of the relations between human freedom and natural necessity or intellectual determinism or grace. Although Descartes does say in the *Meditations* that agents cannot but assent to clear and distinct ideas, which might seem to imply that he was a compatibilist about the relation between clear and distinct ideas and the will, more work needs to be done on the nature of volitional necessity in question before accepting this conclusion. Although we have seen that he does mention the associated and structurally analogous topic of the relation between human freedom and divine providence (AT VIIIa 20, CSM I 206), he does not seriously engage it. More attention needs to be given to the question of the proper problem space in which Descartes' account of freedom is to be located in order better to determine just how his notion of freedom should be conceptualized.

See also Automaton; Clarity and Distinctness; Error, Theodicies of; Eternal Truths; Faculty; God; Hobbes, Thomas; Jesuit; Judgment; *Meditations on First Philosophy*; Mesland, Denis; Petau, Denis; *Principles of Philosophy*

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SEAN GREENBERG

FREINSHEMIUS (JOHANNES FREINSHEIM) (1608–1660)

Born in Ulm, Germany, Freinshemius was a scholar of ancient Roman history and was named to a chair at the University of Uppsala in 1641, and then five years later he was called to **Queen Christina's** court in Stockholm as her librarian, historiographer, and literary major-domo.

The story has it that the French ambassador **Chanut** suggested that the queen might best facilitate her reading of Descartes by having Freinshemius read it with her, with the result that since the latter felt the same need of a reading companion, Chanut also wound up reading Descartes. The queen had had a particular interest in the sovereign good and chose it as a topic for a public

speech at the university, but she found Freinshemius's account superficial and wanted to know Descartes' view of the matter. This might have led to Chanut's **correspondence** with Descartes on the topic of love in 1647 and eventually to his invitation to Stockholm. Concerned about how as a foreign, Catholic notable he would be received at court, Descartes wrote to Freinshemius about what he should do (AT V 362–63). (The reassurances he received, though honest and well intended, proved not to be entirely accurate, though through no apparent fault of Freinshemius.) According to Descartes, Freinshemius was present for the early-morning lessons in **philosophy** that he gave Christina in her library (AT V 466, CSMK 383).

After five years at the court, he left Sweden, because of the climate, and went to Heidelberg, where he died, with the titles of counselor to the elector of the Rhine Palatinate, brother of **Princess Elisabeth**, and honorary professor at the University.

See also Chanut, Hector-Pierre; Christina, Queen of Sweden; Elisabeth, Princess of Bohemia

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THOMAS M. LENNON

FROMONDUS, LIBERTUS (LIBERT FROIDMENT) (1587–1653)

Fromondus was born in Haccourt sur Meuse, Belgium, near Liège, and was educated in humanities at the **Jesuit** college in Liège. He left in 1604 to study **philosophy** and languages at the Collège de Faucon in Louvain; there he befriended a Dutch student, Cornelius Jansen of Acquoy, the future Jansenius. Fromondus then taught philosophy at the Abbey Saint-Michel in Anvers. He returned to Louvain in 1609, where he taught rhetoric (1609–14) and philosophy (1614–28), while pursuing the scientific interests that led to the publication of several astronomical treatises; these included the astronomical fantasy *Coenae saturnalitiae, variatae Somnio sive Peregrinatione coelesti* (1616), *Dissertatio de cometa anni 1618* (1619), and *Meteorologicum libri VI* (1627). In the latter two treatises, Fromondus argued against Aristotle (and in the *Meteors* also against **Galileo**) that comets are superlunary phenomena. In the 1620s, he resumed his studies in theology under Cornelius Jansen (with whom he

would remain closely associated) and obtained a doctorate in theology in 1628. He published in this period, among other works, *Labyrinthus sive de compositione continui*, a defense of Aristotle and attack on atomism (1631), and *Ant-Aristarchus sive Orbis terre immobilis*, a critique on the work of the Dutch Copernican Philip van Lansbergen (1631); Jacob Lansbergen replied with *Apologia ...* (1633), a defense of his father's work, and Fromondus replied with *Vesta, sive Ant-Aristarchi vindex* (1634). When Jansenius was appointed bishop of Ypres in 1636, Fromondus assumed his chair as professor of Sacred Scripture. During his fatal illness in 1638, Jansenius entrusted the manuscript of his *Augustinus* to Fromondus, who arranged for its publication in 1640. Fromondus subsequently published several theological works in defense of **Jansenism**. He died in 1653 in Louvain.

Fromondus was one of the small circle of savants to whom Descartes sent a copy of his *Discourse on Method*. Fromondus replied by sending to Descartes his *Labyrinthus sive de compositione continui*, his tract against Epicureans and atomists, and provided him with a series of objections against what he saw as Descartes' overreliance on atomistic and mechanical principles. Concerning Descartes' account of **body** in the *Meteors*, Fromondus commented: "This composition of bodies made up of parts with different shapes ... by which they cohere among themselves as if by little hooks, seems excessively crass and mechanical" (AT I 406). Descartes clearly respected Fromondus, although he thought him too philosophically conservative. His attitude toward his critic nevertheless remained cordial. In a 1638 letter, Descartes explained that his disagreement with Fromondus was "conducted like a chess game: we remained good friends after the match was over, and now we send each other nothing but compliments" (AT II 660).

See also Atom; Body; Jansenism; Plempius, Vopiscus Fortunatus

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ROGER ARIEW

GALILEI, GALILEO (1564–1642)

Galileo was born near Pisa and died at Arcetri, near Florence. He taught **mathematics** at Pisa and then moved to the University of Padua in 1592. In 1610 he was appointed chief mathematic and philosopher to the Grand Duke (of Florence). In 1632 he published his *Dialogue concerning the Two Chief World Systems*. In 1633 he was convicted on suspicion of heresy. He abjured and was sentenced. In 1638 he published *Discourses and Mathematical Demonstration concerning Two New Sciences*.

Around 1590 Galileo reached a conclusion in *De Motu* about the inadequacy of Aristotle's conception of natural **motion** and the nature of matter (Galilei 1890–1909, vol. 1). In this unpublished work, he argued that all matter (at least in the sublunary world) was the same – there was no light matter that naturally moved up. All matter moved down by weight (or specific gravity). For the next twenty years he would attempt to develop these ideas into numerous insights about the nature of motion and unitary nature of matter.

In March 1610, Galileo published *Sidereus Nuncius* (*The Starry Messenger*) in which he reported his telescopic observations. He claimed that there were mountains on the moon, that there were numerous stars hitherto unseen, and that Jupiter had four moons. The observations served to support his denial of a celestial-terrestrial distinction. In April 1611, Cardinal Bellarmine wrote to the Roman College (Collegio Romano) asking it for an opinion on Galileo's observations. The members of the collegio responded quickly, affirming all of Galileo's observations, but noting that Father **Christoph Clavius** still had some doubts about the mountains on the moon. Galileo moved back to Florence (from Padua), accepting a position with the Medici as "Chief Mathematician of the University of Pisa and Philosopher to the Grand Duke." In 1613 he published *Letters on the Sunspots* in which he first expressed his position in favor of Copernicus and discussed the phases of Venus and the rotation of spots on the sun.

In 1613–14 Galileo entered into discussions of Copernicanism, through his student Benedetto Castelli, and wrote a Letter to Castelli. In 1616 he transformed this into the *Letter to the Grand Duchess Christina*. In this work, Galileo argued that the Bible is a historical document written so that it could be understood by the common people at the time. When it contradicts what we knew by natural **philosophy**, then the Bible must be reinterpreted. In February 1616, the Sacred Congregation of the Index condemned Copernicus's book *On the Revolution of the Heavenly Orbs*, pending correction. On March 26, 1616, Galileo was called to Cardinal Bellarmine's office in Rome, where he was notified that he was "to abandon completely the [Copernican] opinion that the sun is at rest at the center of the world and that the earth moves. And hence forth not to hold, teach or defend it in any way whatever, either orally or in writing" (Finocchiaro 1989, 147).

In 1623 he published *Il Saggiatore* (*The Assayer*), in which he defended the claim that comets were sublunary phenomena. This was a polemic directed at Orazio Grassi, a **Jesuit** mathematician at the Collegio Romano. This same year Maffeo Barberini, Galileo's supporter and friend, was elected Pope Urban VIII. Galileo felt empowered to begin work on his *Dialogues concerning the Two Great World Systems*. It was published with an imprimatur from Florence (but not Rome) in 1632. In it, Galileo portrayed a conversation about the merits of Copernicanism as opposed to the Ptolemaic system in which he gives good reasons to believe in the Copernican theory. He showed that the Copernican theory could handle all the problems about a moving earth and so was at least as coherent as the Ptolemaic theory. He also introduced his theory of the tides, which was meant as a mechanical proof that the earth moved.

Shortly afterward, the Inquisition banned the sale of the *Dialogues*, and Galileo was ordered to Rome for trial. On June 21, 1633, the guilty verdict was handed down. Galileo was made to recite and sign a formal abjuration and was sentenced to house arrest. Despite this setback, though, he went to work on **mechanics**, and managed to smuggle out of Italy a book manuscript that was published in Holland in 1638, as *Discourses on Two New Sciences*. This is generally taken to be Galileo's most lasting scientific work. The second science dealt with the principles of local motion in which he enunciates the law of free fall, the parabolic path for projectiles, and his physical "discoveries." The first science has been called "the science of the strength of materials." However, it is not about the strength of materials per se. It is Galileo's attempt to provide a mathematical science of his unified matter.

Descartes reacts to Galileo's condemnation in letters to **Mersenne**. In a letter from December 1632, Descartes first mentions Galileo on the topic of falling bodies. Later, Descartes expresses dismay at Galileo's condemnation and affirms that he "did not want to publish a discourse in which a single word could be found that the Church would have disapproved of" (AT I 271, CSMK 41). In April and August 1634, Descartes again writes to Mersenne about Galileo and his condemnation, and expresses reservations about the **explanations** of motions that Galileo had provided in the *Dialogue*. In 1637 Descartes comments on and rejects Galileo's treatment of free fall (AT I 392). In 1638 he has more elaborate critical comments of Galileo's *Discourses on the Two New Sciences*. He objects to the way Galileo handles the **geometry** regarding the parabola and basically to his geometrical methods in general (AT II 380, CSMK 124ff.).

Descartes thinks he has a way out of the Copernican problem and publishes it in his *Principles of Philosophy* (1644). He relies on the relational conception of motion, which he proposes in part II.23–30, when he writes in part III.28 that, "strictly speaking, the earth does not move, any more than the planets, although they are all carried along by the heaven" (AT VIIIA 90, CSM I 252) (see **earth, motion of the**).

See also Body; Clavius, Christopher; Earth, Motion of the; Explanation; Geometry; Mechanics; Mersenne, Marin; Motion; Physics

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GASSENDI, PIERRE (1592–1655)

Born at Champtercier in Provence on January 22, 1592, Gassendi is best known today as the author of the notoriously hostile Fifth Objections to Descartes’ *Meditations*. He was also a priest, an astronomer, a humanist scholar, and a defender of Galileanism. But the achievement that earned him a reputation on par with Descartes’ among their contemporaries was the construction of a neo-Epicurean, atomist system of philosophy.

Gassendi spent his adult life in Paris and Provence, traveling back and forth between the two regularly. As a young man, he briefly held the chair of philosophy at the Université d’Aix. In 1645 he was made professor of **mathematics** at the prestigious Collège Royal. (This appointment was due to his reputation as an astronomer,

since astronomy was a branch of mixed mathematics. However, for most of his career, he was dependent on a succession of increasingly prestigious patrons. His chief intellectual relationships were with the other members of the **Mersenne** circle and especially with Mersenne himself.)

Gassendi died leaving his major work, the *Syntagma philosophicum*, unfinished. His executors assembled the text we have from manuscripts produced over decades; this may help to explain the somewhat repetitive and disorganized nature of the almost two-thousand-folio-page *Syntagma*. It covers what Gassendi, following the Hellenistic philosophers, conceived of as philosophy's three parts: logic, **physics**, and ethics. In logic – which, for Gassendi, encompasses epistemology, psychology, and methodology – he insists upon the senses as the source of **ideas** and the criterion of **truth**. In physics – which includes **metaphysics** and all of the natural sciences – he argues that the world is composed of **atoms** with size, **shape**, and **motion** (or motive power), moving in absolute space and **time**. He is thus a key founder of the mechanical philosophy, although it is worth noting that in practice Gassendian physics is highly nonreductionist and almost entirely qualitative. Gassendi's ethics forms a key part of his reconciliation of Epicureanism with Catholicism, while at the same time being heavily influenced by **Hobbes**.

Gassendi's other main philosophical works are the anti-Scholastic treatise *Exercitationes paradoxicae adversus Aristoteleos* (1624); the *Fifth Objections*; and the *Syntagma philosophiae Epicuri* (1649) and *Animadversiones in decimum librum Diogenis Laertii* (1649), earlier versions of his neo-Epicurean project. He also published several astronomical works and two treatises defending the Galilean science of motion and its implications, *De motu impresso a motore translato*, *Epistolae duae* (1642) and *De proportionibus, quae gravia decidentia accelerantur epistolae tres* (1646), as well as other works. **François Bernier**'s eight-volume *Abrégé de la philosophie de Gassendi* (1684) and **Walter Charleton**'s *Physiologia Epicuro-Gassendo-Charltoniana* (1654) helped disseminate his views in the vernacular.

Gassendi's *Objections* and Descartes' *Replies* take in almost all the major themes of the *Meditations*. Gassendi attacks Descartes' methodology: he calls for "something like a chemical investigation of the **mind**" in place of what Descartes does, and elsewhere he compares "the logic of Descartes" unfavorably with the logic of **Bacon**. Along similar lines, he objects to Descartes' use of **clarity and distinctness** as the criterion of truth, arguing that since the apparently clear and distinct **perceptions** of different thinkers disagree, the criterion is unhelpful. Descartes replies that the apparently clear and distinct perceptions of those who – like Gassendi – are still mired in the senses are irrelevant, and that his **method** works for those who apply it correctly. Gassendi, thinking of the Cartesian "I" as a disembodied mind rather than a full person, addresses Descartes as "O Mind"; in response, Descartes calls him "O Flesh." This hostile and uncomprehending exchange sets the tone for the remainder of the *Objections and Replies*, which focuses on topics such as the Third and Fifth

Meditation arguments for the **existence** of **God**, the Fourth Meditation account of **free will**, the alleged reification of **essences** in the Fifth and Sixth Meditations, the alleged circularity of Descartes' apparent reliance on God to guarantee the truth of clear and distinct perception (see **Circle**, **Cartesian**), and the real distinction between mind and **body**. Descartes' *Replies* rarely add much to our understanding of the *Meditations*: for instance, in response to the circularity objection he simply refers the reader back to earlier *Replies*. After the publication of Descartes' *Replies*, Gassendi responded with a book-length set of *Counter-Objections* (the *Disquisitio Metaphysica*), which Descartes answered very briefly in the letter to **Clerselier** of January 12, 1646 (AT IXA 202–17).

See also Atom; Charleton, Walter; Circle, Cartesian; Clarity and Distinctness; Galilei, Galileo; Hobbes, Thomas; Mersenne, Marin; Mind; *Objections and Replies*; Physics

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ANTONIA LOLORDO

GEOMETRICAL EXPOSITION

In the Second Set of Objections to the *Meditations*, Descartes is asked to “set out the entire argument in geometrical fashion, starting from a number of **definitions**, postulates and axioms” (see Objections and Replies). The objectors then add, “You are highly experienced in employing this **method**, and it would enable you to fill the **mind** of each reader so that he could see everything as it were at a single glance, and be permeated with awareness of the divine power” (AT VII 128, CSM II 92). **Mersenne** and his fellow objectors, in effect, are asking Descartes to do for his **meta-physics** what Euclid had done for **geometry**. Euclid in *The Elements* systematizes geometry by using what came to be known as the geometrical method. That is, by using a small set of stipulated definitions, axioms, which are taken to be self-evident, along with postulates, which are sometimes understood to be assumptions that are not self-evident (Heath 1926, 1:123–24), together with the rules of **deduction**, various theorems can then be demonstrated.

Descartes replies to the second set of objectors’ request by making a distinction between the *order* and the *method* of demonstration when writing in a “geometrical manner.” The geometrical order, as he describes it in both the Second Replies and the synopsis to the *Meditations*, is one by which claims or items that come first must be entirely known without the aid of those that come later in the demonstration (AT VII 154, CSM II 110; AT VII 4, CSM II 5). In turn, what comes later in the demonstration must rely solely on what came before. Some have wondered whether Descartes means these items to be ontologically or epistemically prior – that is, first in the order of being or first in the order of discovery (CSM II 110 n. 2 and 112 n. 1). However, given that Descartes proves **God**’s existence in the Third Meditation and his own existence, which depends on God, in the Second Meditation, it seems fair to assume that he means first in the order of discovery and not in the order of being.

As far as the order goes, Descartes claims that the *Meditations* do indeed follow the order of the geometrical method. However, he makes a distinction between two different methods of demonstration – analysis and synthesis (see **analysis versus synthesis**). It is the synthetic method that Descartes ascribes to the geometers and the analytic to his own method of exposition in the *Meditations*. He understands Mersenne and the others to have requested him to, in effect, expound his ideas in the synthetic method. The synthetic method, unlike analysis, follows not the order of discovery but rather Euclid’s method of exposition. The strength of this method, Descartes believes, is that if the definitions, axioms, and postulates are accepted, the conclusions reached cannot be denied even by the most “stubborn and argumentative” of interlocutors, since, as he says, whatever is in the proposition is already contained in what has gone before (AT VII 156, CSM II 111). However, Descartes emphasizes that this method is ill-suited

for expounding metaphysical ideas since he believes it nearly impossible to attain agreement on the very starting points of the demonstration, namely, the axioms and definitions. Nonetheless, Descartes begrudgingly agrees to show Mersenne how some of the important conclusions reached in the *Meditations* can be set in “geometric fashion” (AT VII 160–70, CSM II 113–20). He does so by providing a set of ten definitions, seven postulates (which, as Descartes’ English translators note, is a play on words, given that the Latin term *postulata* can also mean “requests”; see CSM II 114 n. 3), and ten axioms. He then proceeds to demonstrate four propositions using the definitions and axioms he previously offered. The first three are proofs for **God’s** existence (see **ontological argument** and **cosmological argument**), and the fourth is the proof for the real **distinction** between **mind** and **body**.

It is clear that **Spinoza** was very sympathetic to the request made of Descartes in the Second Objections, and one might say even enamored with putting metaphysical theories in geometrical form. His first attempt at this was to rewrite the first two parts of Descartes’ *Principles of Philosophy* in geometrical form and to add a small appendix – this is known as Spinoza’s *Principles of Cartesian Philosophy*. He later proceeded to present his own magnum opus, *The Ethics, ordine geometrico demonstrata* (demonstrated in geometrical order), thereby strongly disagreeing with Descartes as to the usefulness of the geometrical or synthetic method when expounding metaphysical ideas.

See also Analysis versus Synthesis; Cosmological Argument; Deduction; Definition; Geometry; God; *Meditations on First Philosophy*; Mersenne, Marin; Metaphysics; Method; *Objections and Replies*; Ontological Argument; Spinoza, Benedictus

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NOA SHEIN

GEOMETRY

Traditionally, the science of geometry was taken to be an abstract inquiry into the properties of continuous spatial magnitudes (lines, surfaces, angles, and solids). The geometrical **method** proceeds by strict **deduction** from clearly grasped and transparently true first principles, such as Euclid's first axiom (see **common notion**): "Things which are equal to the same thing are equal to one another" (Euclid 1926[1956], 1:222). This account of geometry distinguishes it from the science of arithmetic on the basis of its object: whereas geometry is the science of continuous quantities, arithmetic is the deductively organized study of discrete quantities ("multitudes" or "numbers" in the traditional parlance). The great geometers of Greek antiquity, Euclid, Archimedes, Apollonius, and Pappus, left behind an immense body of results whose level of technical sophistication was unmatched until the seventeenth century. Much of the work of geometers in Descartes' day was directed toward the preparation of editions and translations of the work of classical Greek geometers, as well as speculative "restorations" of lost treatises on a variety of geometrical subjects. With the 1637 publication of Descartes' *Geometry*, the subject underwent a profound and permanent change.

The particulars of Descartes' involvement with geometry before the publication of the *Geometry* are very difficult to assess. His mathematical education at La Flèche was certainly guided by study of the works of the **Jesuit** mathematician **Christopher Clavius**, notably his Latin edition of Euclid's *Elements* with its extensive commentary (first published in 1574 and a standard work in the Jesuit mathematical curriculum) as well as a 1608 *Algebra*. On his arrival in the Netherlands in 1628, Descartes was in possession of what **Isaac Beeckman** called an "Algebra" (*Journal* 3: 94–95) that was evidently an early version of the *Geometry*. In a 1619 letter to Beeckman, Descartes announced that he had "discovered four remarkable and completely new demonstrations" and declared his intention to produce "a completely new science that will provide a general solution of all possible sorts of problems involving any sort of quantity, whether continuous or discrete, each according to its nature" (AT X 154, 157). It is apparent that even at this early stage in his mathematical career Descartes sought to apply algebraic techniques to study all types of **quantity**, with the result that the classical division between arithmetic and geometry was undermined. For Descartes,

the application of algebra to geometry makes both geometry and arithmetic aspects of an algebraic science of “quantity in general” that encompasses them both. This is the methodological approach that dominates the *Geometry*, and an account of the contents of that work will give a reasonably complete picture of Descartes’ geometrical contributions. Geometrical work appears in Descartes’ **correspondence** and in other works unpublished in his day (such as the *Rules*), but the essentials can be understood by attending to the *Geometry*; so this entry will be concerned with explicating that work.

The *Geometry* is divided into three books. Book I sets out the foundations of the Cartesian approach to the subject and considers problems that can be solved by the construction of lines and circles; this book is notable for its solution to the ancient locus problem proposed by Pappus of Alexandria. The second book is devoted to criteria for classifying curves (one involving continuous motions, the other based on algebraic criteria). The third book is a study in the theory of equations and the construction of roots of equations by means of curves. A significant novelty of the format of the *Geometry* is its lack of the traditional apparatus of **definitions**, axioms, postulates, numbered propositions, lemmas, and corollaries. Instead, Descartes assumes that his reader is familiar with a significant amount of classical geometry and early modern algebra and proceeds from one topic to another, marking the course of his argument with only an unnumbered *Table de matières* and a series of marginal notes that correspond to the headings in the *Table* (for more on the structure and approach of the *Geometry*, see Bos 1993).

The fundamental insight in the *Geometry* can be found in the first sentence of the first book with the marginal heading, “How the calculus of arithmetic is related to the operations of geometry,” where he declares: “Any problem in geometry can easily be reduced to such terms that a **knowledge** of the lengths of certain straight lines is sufficient for its construction” (AT VI 370). In this scheme, arithmetical operations (addition, subtraction, multiplication, division, and the extraction of roots) are interpreted as geometrical constructions applied to straight lines that yield other straight lines as results. This stands in contrast to the approach of classical authors, who took the product of two lines to be a surface or the product of three to be a solid. Classically, there is no geometrical meaning assignable to equations beyond the third degree, but Descartes’ principle of “dimensional homogeneity” allows the construction of equations of arbitrary degree and their use in studying geometrical curves. Moreover, by interpreting a curve as an equation in two unknowns x and y that form the axes of a coordinate system, Descartes could represent curves in a two-dimensional plane as an algebraic relation holding between geometrical magnitudes.

Descartes proposed a general method of solution for geometrical problems in the form of an analysis that begins with the supposition that the problem has been solved and then proceeds to uncover the algebraic equations upon which such a solution would depend:

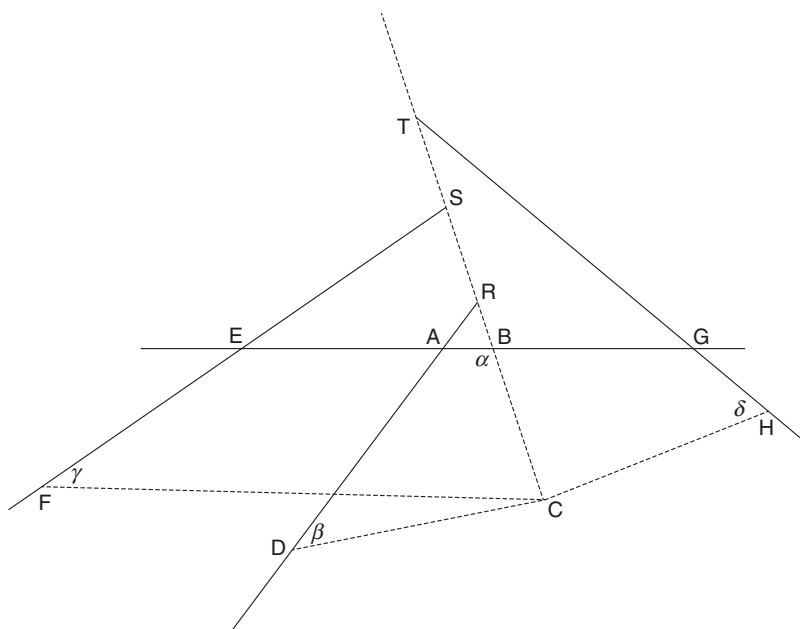


Figure 6. The Pappus problem (*Geometry*, 1637).

If, then, we wish to solve any problem, we first suppose the solution already to have been effected, and give names to all the lines that seem needful for its construction – those that are unknown, as well as those that are known. Then, making no distinction between known and unknown lines, we must unravel the difficulty in any way that shows most naturally the relations between these lines, until we find it possible to express a single quantity in two ways. This will constitute an equation, and we must find as many such equations as we have supposed lines which are unknown. (AT VI 372–73)

This procedure involves three distinct steps – naming, equating, and constructing – and it suffices to solve all problems whose construction requires only “ruler and compass” constructions, that is, the drawing of straight lines or circles (Mancosu 2008).

Descartes illustrated the power of this approach by applying it to the solution of famous problems from antiquity that had resisted solution. In particular, he showed how to apply it to solve the ancient “four line locus” problem posed by Pappus in the seventh book of his *Mathematical Collection* (Pappus of Alexandria 1875[1965], 2:675–81; cf. Heath 1931[1963], 451–59). A locus problem involves finding the collection of points (the *loci*) that satisfy a given condition. In the case of the Pappus problem, we are given four lines in position, AB, AD, EF, GH, and four angles α , β , γ , δ ; the task is to find the locus of points C such that lines can be drawn from C to all the lines AB, AD, EF, GH, making angles α , β , γ , δ , and satisfying the relation $CB \cdot CF = CD \cdot CH$ (Figure 6).

True to the analytic procedure he outlined, Descartes solved the Pappus problem, first by assuming that the desired result had been found and then by taking one of the given lines (AB) and one of the lines to be found (BC) as “principal lines,” or the basis of a coordinate system, designating them x and y respectively. The statement of the problem assures that other known segments (EA and AG) can be identified, and because the angles α , β , γ , and δ are also given, it is possible to express their sines and cosines as ratios between line segments. These ratios allow the lengths of lines BR, CD, CF, and CH in terms of ratios between the principal lines x and y . From this information, together with the condition that $CB \cdot CF = CD \cdot CH$, Descartes proceeded to the second stage of the analysis, expressing the lengths of the lines through C in terms of x and y . The result is a second-degree equation in x and a second-degree equation in y . To complete the solution, Descartes moved to the third stage of his analysis: constructing an equation that will express locus of points C satisfying the constraints of the original problem. This involves taking an arbitrary value of y and determining the root of the equation in x ; since we can construct the relevant root of any second-degree equation in x , the locus of all points C is generated by solving for arbitrary values of y . As Descartes puts the matter: “Taking successively an infinite number of different values for the line y , we would also find an infinite number of values for the line x ; and thus we would have an infinity of different points such as that marked C, by means of which we could describe the required curve” (AT VI 386).

The second book of the *Geometry*, entitled “On the Nature of Curved Lines,” is principally concerned with setting out two criteria by which the geometrical admissibility of curves may be judged. Ancient Greek geometers, notably Pappus, had distinguished three classes of problems, depending on the nature of the curves required to solve them. Planar problems require only compass and rule solutions – that is, they can be solved by constructing circles and straight lines; more complex “solid problems” require conic sections (i.e., curves generated from intersecting a plane and a cone). Beyond these are “linear” problems that require still more complex lines “having a more varied and intricate generation, such as the spirals, the quadratics, the conchoids and the cissoids” (Pappus 1875[1965], 1:55). In the Greek scheme of classification, the plane and solid curves were taken to be unproblematically geometrical, while the status of the more complex curves remained unclear. Some authors took them to be merely “mechanical” and placed them outside the purview of true geometry, whereas others saw them as capable of expanding geometrical methods (Molland 1976; Bos 2001, ch. 3). For his part, Descartes was convinced that there was a firm division between truly geometrical curves and those merely mechanical curves that he deemed ungeometrical. In fact, the second book of the *Geometry* is devoted to distinguishing these two classes of curves.

It is worth considering two of these more complex lines in order to understand Descartes’ conception of geometrical exactness and constructability. The spiral of

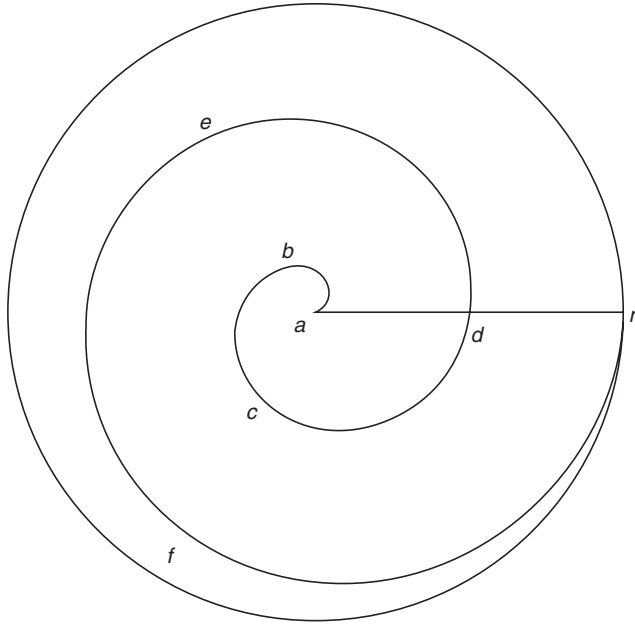


Figure 7. The spiral of Archimedes.

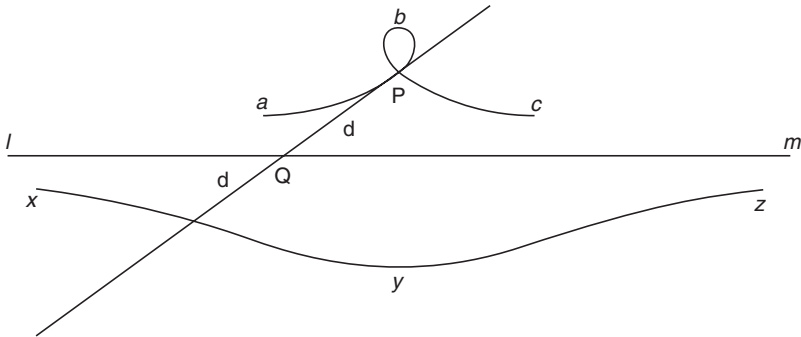


Figure 8. The conchoids (*Geometry*, 1637).

Archimedes *abcdefn* (Figure 7) is described by the combination of two motions: a rectilinear motion of a point through the radius *an* while the radius revolves about the endpoint *a*.

The conchoids are a pair of curves *abc* and *xyz* (Figure 8) defined in terms of a given curve *lm* (in this case, a straight line), a fixed point *P*, and a fixed distance **d**. The defining condition is that for any line passing through *P* and cutting *lm* at *Q*, the two points at distance **d** from *Q* lie on the conchoids.

Descartes accepted that there was an important distinction between truly geometrical and merely mechanical curves, but he thought that Pappus and the ancients were too restrictive in their criteria for what should count as geometrical. He argued

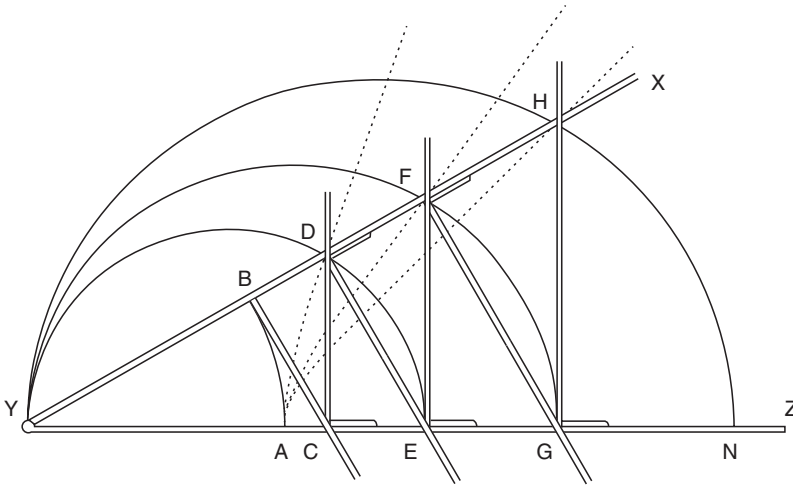


Figure 9. The proportional compass (*Geometry*, 1637).

that if curves such as the conchoid count as mechanical simply “because there is need to use some **machine** to describe them,” such a criterion would also require straight lines and circles to be deemed mechanical “since these can only be described on paper with a compass and rule, which we could also call machines” (AT VI 388). Instead, Descartes held that the truly geometrical is that which is “precise and exact, whereas **mechanics** is not,” with the result that “we have no more right to exclude the more complex curves than the simpler ones, provided that they can be conceived of as described by a continuous **motion** or by several successive motions, each motion being completely determined by those which precede. For by this means we can always have an exact **knowledge** of the magnitude of each” (AT VI 389–90). In fact, Descartes held that what led ancient geometers to deem all curves beyond the conic sections “mechanical” was the accident that the first ones they considered (such as the spiral) depend upon the composition of two motions – one rectilinear and the other circular – and these “do not bear a relation to one another that we can measure exactly” (AT VI 390). Such curves count as mechanical rather than geometrical in Descartes’ scheme (Mancosu 2008, Mancosu and Arana 2010). But the conchoids and similar curves can be traced by means that do not require the comparison of circular and rectilinear motions and are therefore geometrical in the Cartesian sense.

To explicate his notion of geometrical curves as described by combinations of continuous motions, Descartes described a pair of devices that extrapolate from the familiar compass and rule to effect the construction of complex curves. The first is a compass consisting of several rulers linked together (Figure 9). Taking YZ as fixed and Y as a pivot, the rule BC is fixed perpendicular to YX, while DE, FG, and so on remain perpendicular to YX but slide freely along it; likewise, CD, EF, and so on remain perpendicular to YZ but slide freely along it. In the initial position, YX

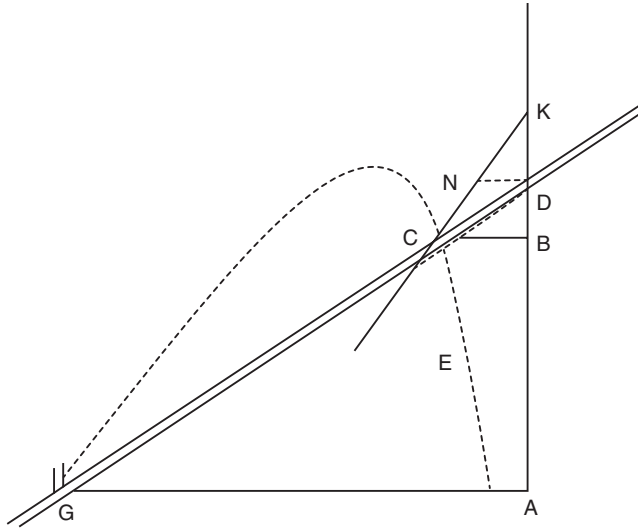


Figure 10. Combination ruler and slide (*Geometry*, 1637).

coincides with YZ , and the rulers are all perpendicular to YZ at A . As YX opens, the point B describes a circular arc AB , and the fixed ruler BC pushes the sliding ruler CD , which describes the line AD ; likewise, CD pushes DE , which in turn pushes EF , thus describing the line AF , and so on. The curves AB , AD , AF , AH are thus described by continuous motions with a “precise and exact measure,” and they allow the construction of mean proportionals. Notice that the similarity of right triangles guarantees that $YB:YC = YC:YD = YD:YE = YE:YF = YF:YG = YG:YH$. Setting $YA=YB=1$ and $YC=x$ yields $(1:x) = (x:x_2) = (x_2:x_3) = (x_3:x_4)$, etc. The result is that the original circular motion determines a succession of more complex motions, each associated with a curve. Yet because the original motion is geometrically admissible, and the subsequent motions are completely determined by this simple motion, all the curves satisfy Descartes’ criterion for geometrical admissibility.

The second device (Figure 10) is a combination ruler and slide that generates more complex curves from the motions that generate simpler curves. In effect, the device takes an input curve and generates a more complex output curve from simple motions determined by the input curve. In its first configuration, the device consists of a fixed vertical ruler AK that can be indefinitely extended in either direction; a ruler GL (also indefinitely extensible) that pivots about the point G ; and a rectilinear figure BKC , whose side KL can be indefinitely extended and to which the ruler GL is hinged at L . Allowing L to move freely along the line AK , the intersection of GL and the (extended) line KC determines a curve (which Descartes shows to be a hyperbola determined by an equation of the second degree). More complex curves may then be produced by substituting a second-degree curve for the original rectilinear figure BKC . So, if a circle CKL with center C is substituted for the rectilinear

figure BKC, the result is a conchoid, and ever more complex curves are traceable by further substitutions (AT VI 393–96).

There is no evidence that Descartes ever constructed either of these devices; so they serve rather as idealized means to clarify the “in principle” nature of requirement that properly geometrical curves are constructible by a series of continuous motions standing in known, determinate relations to one another (Serfati 1993, Bos 1981). But after considering the nature of these theoretical machines, we have a reasonably clear notion why Descartes took the Archimedean spiral to be merely mechanical, while classifying the conchoid as properly geometrical. The definition of the spiral requires a direct comparison between the length of a circular arc and a straight line. But Descartes deemed such curves mechanical “because the ratios between straight and curved lines are not known and I believe cannot be discovered by humans, so that one can conclude nothing about them that is exact and certain” (AT VI 412). The conchoid, in contrast, is a curve that can be described without taking the ratio between a circular arc and a straight line as known, just as in the case of the conic sections. Thus, although the construction of the conchoid is more complex than that of any conic section, it can still be determined by a sequence of clearly conceived continuous motions.

Descartes “continuous motion” criterion for geometrical curves is paired with another that we can term the “algebraic” criterion. In Descartes’ formulation of it, “all the points of curves we can call geometric, that is to say that have a precise and exact measure, must necessarily have a relation to all the points of a straight line, which can be expressed by some single equation” (AT VI 392). In Descartes’ mind, at least, these two criteria specified the same class of curves. He evidently held that any curve describable by a determinate series of continuous motions would have an algebraic equation associated with it, which equation describes the relations among those continuous motions (such motions always being referred to a given straight line). The algebraic criterion permits curves to be classified into types or genres on the basis of the degrees of their characteristic equations, and the third book of the *Geometry* is given over to an extensive study of algebraic equations and their use in constructing curves, as well as the use of curves in determining the roots of algebraic equations. Descartes held that in solving a problem only the “simplest” curve should be employed, interpreting this to mean that the degree of any constructing curve be the lowest possible while the relevant equations must be expressed in irreducible terms. Book III of the *Geometry* thus contains a lengthy account of techniques for finding roots of equations and for reducing equations to their simplest form.

In view of its contributions to geometry and algebra, Descartes’ *Geometry* is justly hailed as one of the most important publications in the history of mathematics. It is fair to say that Descartes was the first European geometer to have gone significantly beyond the results achieved by the ancients, and mathematics in the wake of the *Geometry* is a fundamentally transformed discipline. The initial French version (as one of the “Essays” included with the *Discourse on Method*) was widely

hailed by European mathematicians but relatively little understood, in part a result of Descartes' habit of offering relatively little explicit justification for his procedures. Far more influential was the 1649 Latin version published by Frans van Schooten, which added notes and commentary that helped make it the standard work on the subject.

See also Beeckman, Isaac; *Discourse on Method; Geometry; Mathematics; Method*

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GEOMETRY

The only mathematical work written by Descartes, *La géométrie*, was published by the Leiden printer Jan Maire in 1637 as the last of three tracts appended to the *Discourse on Method*. While the *Dioptrics* and the *Meteors* were said to use and exemplify Descartes' philosophical method, the *Geometry* was actually held to demonstrate it (AT I 478, 621; CSMK 77–78).

Before 1636, there is no mention in Descartes' writings of a publication corresponding to the *Geometry*. Nonetheless, the published work does take up ideas found already in the *Rules* and contemporary **correspondence** such as the numerical expression of powers and the construction of mean proportionals by the intersection of a circle and a parabola. Anticipating claims he would later make for the *Geometry* itself, he already announces to **Isaac Beeckman** in March 1619 his plan to formulate an "entirely new science" by which all problems that can be posed concerning all kinds of **quantity**, continuous or discrete, can be generally solved (AT X 156). In effect, his aim then, as later in the *Geometry*, was to show that after him nothing would remain to be discovered in **mathematics** (AT I 340, CSMK 51; AT II 361–62; AT X 157).

Descartes' catalyst for writing the *Geometry* was the Pappus problem that **Jacob Golius** sent to him in 1631. The ancient solution of this problem was unknown to the seventeenth century, and Descartes recognized the importance of the interplay of algebraic equations and **geometry** in solving it. The solution that he discovered in 1632 was accorded a prominent place in the *Geometry* and served to illustrate the power of his geometrical calculus (AT I 323, 244, 478; CSMK 78).

By March 1636, the future publication of the four tracts had begun to take shape, the *Dioptrics*, *Meteors*, and *Geometry* being grouped around a central work, which Descartes then called his "project of a universal science" (AT I 399) (see *Mathesis Universalis*). Finding a suitable printer proved a problem. After failing to come to an agreement with the Leiden Elseviers, Descartes eventually signed an agreement with Jan Maire, the second publisher of note in that city. Printing of the *Dioptrics* began in August 1636, and the *Meteors* probably followed in November or December of that year. The printing process was made difficult because Descartes had decided, at the suggestion of **Constantijn Huygens** (1596–1687), that diagrams be inserted into the body of the text rather than being collected as plates at the end. Production of the woodcuts, which necessarily had to be ready before printing of the corresponding text began, was entrusted to Frans van Schooten (1615–60), son of a professor at the University of Leiden (AT I 611). Because of delays in completing the diagrams for the *Meteors*, Schooten was confined to the publisher's rooms at the end of October (AT I 613–14). Descartes reports that he put together the *Geometry* and conceived one of its parts while the *Meteors* was

being printed, indicating that the text was largely composed from December 1636 onward. Descartes informed Huygens of the definitive title of the composite book in February 1637 (AT I 621), and its printing was completed on June 8. The royal privilege had already been granted in Paris on May 4 (AT VI 515).

Having already played an important part in the realization of the *Geometry*, Schooten also contributed decisively to its reception and dissemination. On Descartes' recommendation, Huygens employed Schooten as teacher of mathematics to his sons **Christiaan** (1629–95) and Constantijn Jr. (1628–97). Schooten used the *Geometry* as the basis for their instruction and later also that of Jan de Witt, Jan Hudde, Hendrik van Heuraet, and others. He was also responsible for the translation of the French *Geometry* into Latin, by means of which the text became accessible to a much wider scholarly audience. Moreover, by complementing the translation with his own extensive commentaries, Schooten helped overcome the notoriously difficult form in which Descartes had presented the text.

The first edition of the *Geometria a Renato Des Cartes* was published, again by Jan Maire, in Leiden in 1649. Read and approved by Descartes beforehand, the work also included **Debeaune's** *Notes brèves*, which Schooten had likewise translated into Latin. By the time of the (more widely distributed) second edition, Schooten had become a close friend of the Amsterdam publishers Daniel and Louis Elsevier. Now expanded to two volumes, published successively in 1659 and 1661, the new edition retained the *Notae brevis*, while Schooten's commentaries (particularly to books II and III the *Geometry*) were considerably expanded. The first volume, whose frontispiece is a portrait of Descartes by Schooten, also contains three studies by Hudde and Heuraet. The second volume is taken up mainly by De Witt's treatise on conic sections together with two further tracts by Debeaune, Schooten's *Principia*, and some minor tracts that had remained unpublished at the latter's death. A third printing of this edition was produced by the Amsterdam publisher Blaeu in 1683.

See also Beeckman, Isaac; Debeaune, Florimond; *Discourse on Method*; Geometry; Huygens, Christiaan; Huygens, Constantijn; Mathematics

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GEULINCX, ARNOLD (1624–1669)

Arnold (or Arnout) Geulincx was baptized in Antwerp in late January 1624. He reportedly spoke Latin fluently even as a child, matriculated at Leuven University in January 1640, and became *professor primarius* there in 1652. Six years later, he seems to have made the decision to move to Leiden because he intended to marry his niece Susanna Strickers, a step his Leuven career as canon and professor prohibited.

It was in Leiden that Geulincx became a Cartesian. Apart from the idea of mind-body **dualism**, his **Cartesianism** was inspired by the notion of epistemological growth found in the paragraphs on childhood **prejudice** in Descartes' *Principles of Philosophy*. Yet Geulincx also went beyond Descartes. Instead of dealing only with **sensations**, he developed a parallel notion of *conceptual* projections on reality, arguing that it is on the basis of our "ways of thinking" (*modi cogitandi*) that we misrepresent things "as they are in themselves." This may well be seen as a prefiguration of Kant, as long as it is kept in mind that Geulincx was not thinking in terms of necessary categories, but rather of epistemological distortions – the misrepresentations of reality consolidated in the concepts of Aristotelian **metaphysics**. According to Geulincx (1891–93, 2:301), to regard things in themselves as **substances** (or even as "things") was simply a way of applying intellectual *phasmata* to the outside world alongside our *phasmata* of sense. Wisdom, on the other hand, results from the fact that "something divine within us" tells us that "it is not so."

Geulincx's epistemology has been read in terms of both an illumination theory (Vleeschauwer 1953) and a theory of vision in **God** (Aalderink 2009). Against this, it must be said that Geulincx never explicitly discussed the question "where" our **ideas** originate. Indeed, unlike **Augustine** and **Malebranche**, but very much like Descartes himself, Geulincx conceived the dissimilarity between sensual information and its intellectual reinterpretation in such a way that there was no need to address the Platonic question as to how ideas might represent objects (see **representation**).

Avoiding any schematization of experience or reification of attributes, Geulincx still saw a possibility for metaphysics on account of the fact that we may distinguish two different realms implied in human experience: experience itself and things that exist outside it – in other words, **thought** and **extension**. Our "first **knowledge**," Geulincx argued, is "*Cogito, ergo sum*" (1891–93, 2:147), and the part of the unfinished *True Metaphysics* that deals with material being opens with the equally Cartesian claim, "**Body** is what is extended" (1891–93, 2:158). Again, however, Geulincx went beyond Descartes. Identifying causality with an inner experience of action, he restricted all genuine forms of activity to an introspective consciousness of doing something. This leads to the maxim "what you do not know how to do, is not your action" (1891–93, 2:150). Despite a shared concern for attributing various forms of causal activity to God, Geulincx's so-called occasionalism is thus of a different nature from other contemporary or medieval forms (Renz and van Ruler 2010).

Relegated to being “spectators” of the world, causally responsible for only thinking and willing, **human beings** should concentrate on their intentions. Though this view of man may link up with Jansenist and Calvinist theological views, it would seem to fit awkwardly with any notion of ethics. Insisting, however, that we should direct the will to whatever our experience suggests as the most reasonable option, Geulincx’s ethics urges man to hold on to life and, in neo-Stoic sense, to fulfill all other requirements that our God-given “human condition” demands.

Despite a short-lived popularity of his *Ethics* in Dutch religious circles, Geulincx’s philosophy fell into oblivion until the end of the nineteenth century, when J. P. N. Land published a new edition of his philosophical works. Besides lesser-known figures such as the Dutch physician Cornelis Bontekoe (ca. 1644–85) and the English philosopher Richard Benthogge (1638–1705), Geulincx may also count Noble Prize winner Samuel Beckett (1906–89) among the admirers of his works.

See also Calvinism, Cartesianism, Cause, Jansenism, Metaphysics

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GIBIEUF, GUILLAUME (1583–1650)

Gibieuf studied at the Sorbonne and received the title of doctor in theology in 1612. The same year he joined the Oratory, recently founded by Cardinal **Pierre de Bérulle**. He quickly became Bérulle's right-hand man and played an important role in the expansion of the Oratory (see **Oratorian**). However, because of internal dissent, he was not elected superior of the congregation at Bérulle's death (1629). From 1631 on, he was kept out of its leadership, for about ten years. He nevertheless remained in charge of the supervision of the Carmelites.

Through Bérulle, Gibieuf associated with Descartes in Paris between 1626 and 1628. After Descartes' departure for the Netherlands, they remained on excellent terms. Gibieuf interceded on Descartes' behalf with the Sorbonne to obtain an approbation of the *Meditations*.

Gibieuf and Descartes share some views on divine and human freedom. As Bérulle's disciple, Gibieuf defended, in his *On the Liberty of God and of the Creatures*, the "Augustinian" thesis of the necessity and invincibility of grace, against the "Molinist" theory that "indifference" is essential to human **free will**. For the **Jesuit** Molina, our will is not free if it cannot choose one of two opposite alternatives indifferently, that is, without being irresistibly inclined to one of these opposites. In contrast, for Gibieuf, inclination is compatible with free will because it is not an external constraint. Indifference is proper only to **God's** supreme freedom. Because of his "amplitude" – namely, his infinity, inexhaustible power, and absolute perfection – God is not limited or constrained in any way regarding his ends or means. On the other hand, in the case of humans, indifference characterizes a will that has gone astray from the path marked by God. Creatures are essentially ordained to God as their end, and human freedom is perfectly achieved in the adhesion to the motion that irresistibly draws us back to God.

Descartes approvingly mentions the Oratorian's 1630 book several times, and although he formulated some of his theses before reading it, he may have discussed orally with Gibieuf these ideas, which bear a strong Neoplatonist mark. Descartes' conviction that God's will is characterized by its absolutely indifferent freedom leads him to affirm the "creation of **eternal truths**." Regarding human freedom, in the Fourth *Meditation* Descartes characterizes indifference as its lowest degree. We are all the more free when we are drawn necessarily to assent to what our intellect shows to be evidently true or good. Far from being the **essence** of freedom, the will's indifference, which we sometimes do experience, is merely a sign of the imperfection of our understanding, which has not yet discovered a clear and distinct **idea** (see **clarity and distinctness**).

See also Bérulle, Pierre de; Eternal Truth; Free Will; Jesuit; Oratorian

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JEAN-LUC SOLÈRE

GOD

Descartes is traditionally described as the father of modern philosophy, but in one way this description is potentially misleading. Since the Enlightenment at least, one of the dominant characteristics of modern philosophy has been its secular tendency; in the philosophy of Hume and his French contemporaries, for instance, God is conspicuous by his absence except as a target of criticism. But Descartes cannot be said to have inaugurated this turn toward secularization; God plays an absolutely central role in his **philosophy** (Cottingham 2008, 289; cf. Williams 1978, 162). Unlike **Spinoza**, Descartes may not be a "God-intoxicated man," but he goes further than most philosophers in exploring the wide-ranging implications of the divine **attributes** for first philosophy and the natural sciences. It is by an appeal to the divine attributes or perfections that Descartes not only bridges troublesome gaps in his epistemology but also lays the foundations for his mechanistic **physics**.

To say that Descartes accords divine attributes a principal place in his philosophy is to say that his God is very much the God of the philosophers deriving from the Greek tradition; in Pascal's words, he is not the God of Abraham, Isaac, and Jacob. Descartes' God is indeed a being whose **essence** and **existence** can be known by the unaided light of nature. The point might seem too obvious to be worth stressing, were it not for the fact that Descartes' most prominent disciple, **Malebranche**,

regularly invokes properties of God that can be known only through revelation; thus, even in philosophical contexts Malebranche appeals to the Word or Second Person of the Trinity. In the *Principles of Philosophy* I.25, Descartes asserts that we ought to assent to the doctrines of revealed theology, such as the Trinity and Incarnation (AT VIIIA 14, CSM I 201), but when practicing first philosophy, he does not avail himself of such doctrines. Although Descartes is prepared to offer an account of **transubstantiation** on his principles, it is more characteristic of him to leave (revealed) theology to the theologians.

1. GOD: DEFINITIONS AND PROOFS

In the First Replies, Descartes claims that “according to the laws of true logic, we must never ask about the existence of anything until we first understand its essence” (AT VII 107–8, CSM II 78). In accordance with this methodological dictum, each of Descartes’ two main proofs of the existence of God, the **cosmological** and the **ontological arguments**, is prefaced by a **definition** of God. Although it is perhaps the supreme perfection of God that does most work in his natural theology, Descartes does not introduce the cosmological proof of God’s existence with a definition couched in these terms; rather, Descartes defines God in terms of a list of properties or perfections (Marion 1986, 298). The meditator reflects that “by the word ‘God’ [he understands] a **substance** that is infinite, [eternal, immutable,] independent, supremely intelligent, supremely powerful, and which created both [himself] and everything else (if anything else there be) that exists” (AT VII 45, CSM II 31). The key attribute for the strategy of the Third Meditation argument seems to be that of actual, as opposed to merely potential, infinity; the meditator perceives that the **idea** of God that he finds in his **mind** is an idea whose objective or representative reality is so great that God alone can be its causal source (see **being, formal versus objective**).

Although this list of properties may seem unproblematic, some features call for comment. In the first place, it is clear that Descartes conceives of God as an individual or particular substance; he thus breaks with the Thomistic tradition, later revived by Malebranche, of regarding God as being in general. Second, Descartes’ claim that God is by definition an infinite substance needs to be understood against the background of the distinction he draws between the infinite and the merely indefinite. Descartes is prepared to apply the term “indefinite” to that which like space or extension is unlimited only in a certain respect. By contrast, Descartes reserves the term “infinite” for God alone; to say that God is infinite is to say not merely that we fail to recognize any limits in him in any respect but that our understanding positively perceives that he has no limits (AT VIIIA 15, CSM I 202; cf. AT VII 113, CSM II 81). By means of this distinction between the infinite and the indefinite, Descartes

is able to secure the complete transcendence of God, which Spinoza was to undermine through his insistence that extended substance is not merely indefinite but infinite (see **infinite versus indefinite**).

The definition is remarkable not only for what it includes but also for what it leaves out. For one thing, Descartes does not say that the concept of God is the concept of a being that is *causa sui* (**cause** of itself). In the First and Fourth Replies, however, Descartes discusses this claim at some length. It is clear that Descartes believes that everything, even God, must have a cause in a positive sense; it is not sufficient to say that, as an independent being, God has no external cause. Aware perhaps that he is walking through a theological minefield, Descartes offers a somewhat convoluted account of the positive sense in which God is self-caused. Descartes concedes to **Caterus** that there is no need to say that God is his own efficient cause (AT VII 110–11, CSM II 80); indeed, such a claim must be rejected if an efficient cause is taken to be distinct from, and prior in time to, its effect. Surprisingly, however, Descartes is prepared to say that God is the cause of his continued existence by virtue of his immense and incomprehensible power (AT VII 110, CSM II 79). Such a claim is strange since it seems to imply that God is a sempiternal being – that is, a being that exists at all times – and is thus inconsistent with Descartes’ more standard, Platonic conception of God’s existence as being outside time altogether. Despite such claims, Descartes’ settled position seems to be that God is self-caused in the sense that his essence involves existence (AT VII 109, CSM II 79); thus, God has a formal cause but not an efficient cause, at least in the strict sense (AT VII 236, CSM II 165).

Perhaps the most striking omission from the list of defining properties is any mention of divine benevolence. The omission is surprising not only by virtue of the central role that this property plays in Descartes’ philosophy but also by virtue of the “malicious demon” hypothesis of the First Meditation; according to this hypothesis, the malicious demon shares with the true God the properties of supreme power and intelligence, or at least cunning (see **doubt**). It is surely central to Descartes’ purposes to put a distance between the concept of God and the concept of a malicious demon, and it seems that this matter might have been settled definitionally. The omission is in a sense repaired later on when the meditator reflects that, though the ability to deceive is evidence of power, the will to deceive is a mark of malice or weakness and thus cannot belong to God (AT VII 53, CSM II 37).

In contrast to the **cosmological argument**, the **ontological argument** is introduced by the traditional definition of God as the supremely perfect being. It is natural to ask, then, whether the definitions to which the two arguments appeal are supposed to be logically equivalent. It might seem that the answer to this question is straightforwardly yes; that is, to say that God is the supremely perfect being might seem to be a shorthand expression for saying that he instantiates all those properties or perfections enumerated in the definition that introduces the cosmological

argument and that this list of perfections is complete. The discrepancy in formulation could then be explained in terms of both the structure of the ontological argument and the meditator's growth in philosophical sophistication. For the purposes of the ontological argument, the important point is that God's essence is constituted by being supremely perfect, and that existence is inseparable from this essence. Further, as he develops philosophically, the meditator moves away from the naïve tendency to simply list God's attributes to the more sophisticated formula according to which God is, by definition, the supremely perfect being (Curley 1978, 164–67).

This interpretation, however, is subject to several difficulties. In the first place, to say that God is the supremely perfect being might be naturally read as meaning that God has all logically consistent attributes or perfections, whatever they may be. Now in the Third Meditation Descartes acknowledges that God may have countless attributes that are unknown to him (AT VII 46, CSM II 32). Such an acknowledgment can of course be reconciled with the definition of God as the supremely perfect being, interpreted in the way proposed. But then it would not follow from the fact that a substance satisfies the definition that introduces the cosmological argument that it also satisfies the definition, in terms of supreme perfection, that introduces the ontological argument. A second difficulty is of a rather different nature. In places Descartes seems not to regard the phrase “supremely perfect being” as a shorthand expression for “a being having all the perfections”; rather, he seems to treat perfection as one of God's properties among others. Thus in *Principles* I.14 Descartes writes of “the idea of a supremely intelligent, supremely powerful *and supremely perfect* being ” (emphasis added; AT VIIIA 10, CSM I 197). A final difficulty is that since, according to the ontological argument, existence is a perfection, it should appear on the list of properties that precedes the causal argument; it is, however, omitted from this list and is not obviously entailed by the properties that are there enumerated. Thus, the two definitions do not appear to be logically equivalent. The relationship between the two definitions remains obscure, but it is still tempting to say that the definition of God as the supremely perfect being is supposed to represent a philosophical advance over the more naïve and perhaps more provisional formulation that Descartes adopts for the purposes of the cosmological argument of the Third Meditation.

Whether the definitions Descartes employs in his cosmological and ontological arguments are equivalent may be disputed, but one thing is not in doubt: Descartes presents his two main proofs of God's existence in reverse order in the *Meditations* and the *Principles of Philosophy*. Famously, the cosmological argument appears as early as the Third Meditation, and it is not until two meditations later that the inquirer sees, through reflection on **true and immutable natures**, that he has the materials for a new proof of God's existence; this proof turns not on how a finite being could possess the idea of God but rather on what is entailed by the content of the idea. The discrepancy cannot be explained by saying that in the Third Meditation Descartes

needs to set the stage for solving the problem of error addressed in the Fourth Meditation, for the attribute of divine benevolence that generates the problem falls out of the definition of God as the supremely perfect being. The actual explanation of the discrepancy presumably lies in the difference between the analytic method, or order of discovery, employed in the *Meditations* and the synthetic method, or order of proof, largely employed in the *Principles of Philosophy*; the analytic method is primarily a means of dispelling ingrained philosophical **prejudices** (Nolan 2005, 536).

Despite the complexity of its details, as an *a posteriori* argument the cosmological proof is more likely to be discovered first by a meditator trained in empiricist and even Scholastic **habits** of thought. By contrast, the ontological argument may seem sophisticated at first sight, but as a result of undergoing the extensive course of philosophical therapy that the analytic method involves, the meditator can come to see the force of the argument; indeed, the meditator will reach a stage where the ontological argument appears less as formal proof than as a case of intuitive **knowledge** (Nolan 2005, 526). In the Second Replies, for instance, Descartes insists that, by reflecting on the fact that the idea of God includes necessary existence, his readers should see that it is self-evident that God exists (AT VII 163, CSM II 115). Thus, the placing of the ontological argument so late in the project of the *Meditations* should not lead us to regard it as a mere afterthought; rather, it is required by the analytic method itself (see **analysis versus synthesis**). Nonetheless, on occasion Descartes seems to insist on the greater importance of the cosmological argument of the Third Meditation; he tells **Arnauld**, for instance, that a consideration of efficient causes is the primary and principal way, if not the only way, of proving the existence of God (AT VII 238, CSM II. 166).

2. THE ROLE OF THE DIVINE ATTRIBUTES

Some of Descartes' most innovative appeals to the divine attributes occur in his theory of modality. In **correspondence** with **Mersenne**, Descartes insists that even the so-called **eternal truths** of **mathematics** depend on him: to suppose, as **Aquinas** does, that these truths are independent of his will is to suppose that God is subject like Jupiter or Saturn to the Styx and the Fates (AT I 145, CSMK 23). There is no doubt that, for Descartes, the doctrine of the creation of the eternal truths, as it is often called, is required by an adequate conception of divine omnipotence; Descartes tells Mersenne that God is a cause whose power surpasses the bounds of human understanding (AT I 150, CSMK 25). But, as recent commentators have emphasized, the doctrine is also required by a truly consistent conception of the divine attribute of simplicity (Walski 2004, 38; Nadler 2011, 532). According to Descartes, the simplicity of the divine nature is violated unless his attributes are strictly identical: in God "willing, understanding, and creating are all the same thing without one being prior

to the other even conceptually” (AT I 153, CSMK 25–26). One target of Descartes’ attack here is the traditional doctrine, later revived by Malebranche, that God creates the world by consulting ideas or archetypes in his **intellect** (Walski 2004, 30).

The interpretation of the doctrine of the creation of the eternal truths is highly controversial. On one reading, such a doctrine implies that there are strictly no necessary truths; the fact that two plus two equals four is in some sense a contingent truth that could have been false if God had willed otherwise (Frankfurt 1977, 42). On a more cautious reading, however, Descartes is committed to saying not that there are no necessary truths but rather that such truths are not necessarily necessary (Curley 1984, 581). The strength of the claim to which Descartes is committed here is controversial in other ways as well. In places, Descartes seems to emphasize not so much the positive claim that God, in his omnipotence, could have made contradictions true but rather the negative thesis that it would be rash to affirm that he could not (AT I 146, CSMK 23) (see Nelson and Cunning 1999). Arguably, moreover, one of Descartes’ chief aims is to divert attention away from the modal status of the eternal truths to their epistemic credentials; the issue that should concern us is not whether they could have been otherwise but whether they are truly certain. In any case, whatever the underlying philosophical motivation for Descartes’ doctrine of the eternal truths, it is clear that he is unwilling to endorse the traditional, and later Leibnizian, view that God’s omnipotence is limited by the laws of logic.

Descartes’ appeal to unprecedentedly strong conceptions of divine omnipotence and simplicity in connection with issues of modality occurs on the margins of his philosophy; its most eloquent expressions are found in letters that were not published in his lifetime. In his chief published works, such as the *Meditations* and the *Principles of Philosophy*, the divine attribute that plays the most prominent role is God’s benevolence, or its corollary, that God is not a deceiver. This doctrine does important work for Descartes at two key stages in his epistemology. In the first place, it is arguably this doctrine that allows the meditator to progress from *cognitio* to *scientia*; in other words, it makes possible the transition from isolated clear and distinct **perceptions**, such as the *cogito*, to the systematic body of certain knowledge in first philosophy and the natural sciences with which Descartes seeks to replace the Aristotelian legacy. How Descartes sees the role of the divine guarantee has been much discussed, but he seems to be working with the following account. At the time of their occurrence, individual clear and distinct perceptions are self-guaranteeing, but when the meditator turns his attention to other matters, he may doubt whether such perceptions are indeed true. It is then by reflecting on the fact that God is not a deceiver that the meditator can take the truth of clear and distinct perceptions for granted. Such an account not only shows how the meditator is able to achieve *scientia* as opposed to mere *cognitio* but also explains how Descartes is able to respond to the charge of circularity raised by Arnauld and the authors of the Second Set of Objections: the crucial point is that clear and distinct perceptions in themselves are in no need of a divine guarantee (Newman and Nelson 1999, 375–76) (see **Circle, Cartesian**).

The fact that God is not a deceiver also plays a crucial and rather dubious role in Descartes' proof of the existence of the external world (see **body, proof of the existence of**). In the *Meditations* and the *Principles*, Descartes seeks to show, by means of an argument by elimination, that his sensory ideas are caused by corporeal objects; to this end he deploys the premise that his propensity to believe that his sensory ideas are caused in this way is so strong that God would be a deceiver if this belief were false (AT VII 80, CSM II 55; AT VIII 40–41, CSM I 223). Descartes is not without resources for defending this argument against the obvious objection that by parity of reasoning we could prove that the sun moves around the earth; God has given us an intellectual faculty by means of which we can correct the one belief but not the other if it were false. But the argument does seem vulnerable to the objection that it accords an epistemic value to his mere propensity to believe a proposition that is inconsistent with his earlier insistence on the need to free our minds of prejudices and preconceptions. It is not surprising perhaps that the argument provoked **Leibniz's** (1875–90, 4:366) derisive comment that Descartes' proof of the existence of the external physical world is so feeble that it would have been better if he had not tried to offer one.

In part II of the *Principles of Philosophy*, Descartes not only appeals to God to justify our claim to know the existence of bodies; he also appeals to him to ground the principles and laws to which they are subject. The divine attributes thus play an important role in making the transition from first philosophy to the “the principles of material things,” the main subject of part II. Having claimed that God is the primary cause of **motion** in the universe, Descartes then invokes divine immutability in order to deduce the principle of the conservation of the same quantity of motion; as Descartes says, “God's perfection involves not only his being immutable in himself, but also his operating in a manner that is always utterly constant and immutable” (AT VIII 61, CSM I 240) (see **conservation of motion, principle of**). The attribute of divine immutability, which follows from God's perfection, further serves to justify Descartes' version of the law of **inertia**: Descartes' first **law of nature** states that “each and every thing, in so far as it can, always continues in the same state; and thus what is once in motion always continues to move” (AT VIII 62, CSM I 240).

The perfection of immutability is perhaps the most prominent of the divine attributes that Descartes invokes in order to justify the principles and laws of his physics. But it is not only properties that follow from God's supreme perfection that determine the anti-Aristotelian character of Descartes' natural philosophy. In the *Meditations* and the *Principles*, Descartes argues that God's purposes are impenetrable and that for this reason we should banish final causes from physics (AT VII 55, CSM II 39; AT VIII 40–41, CSM I 223); thus Cartesian physics will involve no teleological **explanations** such as: “The rain fell so that the crops might grow.” Although Descartes justifies the exclusion of final causes on grounds of piety, it seems that his real motivation is to prepare the ground for his new program of mechanical explanation; here the only causes that are invoked are efficient causes.

Descartes' ascription to God of properties that reflect our epistemic limitations rather than the divine perfections is arguably a source of tensions in his **philosophy**. Thus, his insistence on the impenetrability of God's purposes sits rather uncomfortably with his proof for the existence of **body**. Even if we concede that God cannot be a deceiver, we may still object, as Leibniz (1875–90, 4:367) did, that he may have inscrutable reasons of his own for allowing us to believe falsely that our sensory ideas are caused by physical objects. Descartes would no doubt respond to such an objection by saying, as he did to **Frans Burman**, that since God is a supreme and pure being, he cannot incline to nothingness (AT V 147, CSMK 334); thus God cannot use evil, which is a privation, for the purpose of bringing about a greater good. Moreover, in fairness to Descartes, it should be observed that he sometimes recognizes that his insistence on our epistemic limitations with respect to God may seem to lead to certain tensions. His discussion of divine incomprehensibility is a case in point. Descartes is clearly eager to defend the claim that it is consistent to affirm both that God is incomprehensible in the sense that he cannot be embraced in our thought and that our idea of him is supremely clear and distinct; we can clearly and distinctly understand that God is infinite, although it is of the nature of the infinite that it cannot be grasped by finite minds like ours (AT VII 46, CSM II 32). Descartes' distinction may seem tenuous here, but it can perhaps be defended by **analogy** with the more familiar case of a triangle. The idea of a triangle may be clear and distinct in the sense that we can be certain, for instance, that the equality of its internal angles to two right angles follows from the definition, in combination with the axioms and postulates of Euclidean geometry, but saying so does not imply that we can solve every problem about triangles or prove every theorem that could in principle be proved.

Descartes may have sought to build on the traditional conception of God as the most perfect being and to accord such a being a central place in his philosophical system. But, in spite of Descartes' intentions, certain features of his account of God were viewed with suspicion not only by the Catholic Church but also by some of his leading philosophical successors in the rationalist tradition. Leibniz and Malebranche, for instance, were equally emphatic in rejecting Descartes' doctrine of the creation of the eternal truths. With some irony, Leibniz (1875–90, 4:227) commented that it is a "fine paradox" to maintain that it is only as a result of God's will that two contradictory propositions are never found to be true together; according to Leibniz, such a doctrine depends on a failure to understand that the intellect in general is logically prior to the will. Moreover, Leibniz and Malebranche were both opposed to the underlying voluntarism of Descartes' conception of God on other grounds: to maintain that the rules of goodness, justice, and perfection depend on God's will is to undermine any reason for praising him, since on this view whatever God willed would *ipso facto* be good (Nadler 2011, 541–42). In the case of Leibniz at least, the advent of Spinoza's philosophy offered new reasons for casting aspersions

on Descartes' philosophical theology; in Leibniz's words (1875–90, 2:563), Spinoza merely cultivated certain seeds in Descartes' philosophy. Thus, Descartes' doctrine that final causes have no place in physics since it is rash to presume to know God's purposes paved the way for Spinoza's radical rejection of divine teleology. Moreover, Descartes' definition of "substance" in the *Principles of Philosophy* as that which is independent of everything else also sowed the seeds of Spinozism, since Descartes immediately draws the inference that, strictly speaking, only God satisfies this definition (AT VIII A 24, CSM I 210). It is thus one of the ironies of the history of philosophy that, while Descartes sought to uphold the complete transcendence of God, he was seen as the natural forerunner of a philosopher whose system was uncompromisingly pantheistic.

See also Analysis versus Synthesis; Attribute; Being, Formal versus Objective; Body, Proof of the Existence of; Circle, Cartesian; Cause; Cosmological Argument; Definition; Essence; Eternal Truth; Existence; Idea; Infinite versus Indefinite; Knowledge; Leibniz, Gottfried Wilhelm; Malebranche, Nicolas; Ontological Argument; Spinoza, Benedictus; Substance

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NICHOLAS JOLLEY

GOLIUS, JACOB (1596–1667)

Jacob (Van) Gool was born 1596 in The Hague. He studied **medicine, mathematics**, and astronomy at Leiden (1612). His interest in Greek mathematics led him to enroll a second time and learn Arabic with the famous orientalist Erpenius (1584–1624) and, on his own, to learn Turkish, Armenian, Persian, and Chinese. To improve his knowledge, he became secretary to a Dutch embassy to Morocco (1622–24). At his return he was appointed professor of oriental languages at Leiden. He then obtained permission to make a long journey to the Middle East, from which he returned with more than three hundred Arab, Turkish, and Persian manuscripts, his most sensational discovery being an Arab translation of three missing books of Apollonius's *Conica*. Back in Leiden (1629) he was offered a second chair, in mathematics and astronomy (the first Leiden observatory was founded by him). After his death in 1667, his manuscripts were bought by Narcissus Marsh (1638–1713), who in turn donated them to the Bodleian Library (lack of funds forced Leiden to be satisfied with copies).

Combining without effort philological and mathematical studies, Golius was one of the main interpreters of Arab science for the seventeenth-century West. Descartes came to know him when, attracted by the news of the lost books of Apollonius, he enrolled at Leiden University in May 1630. Before long the two became friends. Two letters written to Golius in January and February of 1632 show that Descartes gave him the manuscripts of the *Dioptrics* and the *Geometry* (AT I 232–35, 236–41). Golius in turn visited the philosopher in Amsterdam (Huygens, *Briefwisseling* I, 349). Like **Constantijn Huygens**, Golius urged Descartes to reverse his decision of 1633 to withhold publication of *The World* and encouraged him to publish the *Discourse on Method* (1637). Descartes in turn wanted him to sit on the committee that arbitrated between him and Jan Stampioen (see **The Stampioen Affair**). During the troubles that accompanied the introduction of **Cartesianism** at Leiden University, Golius's great authority allowed him to play a moderating role.

See also Huygens, Constantijn

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THEO VERBEEK

GRANDAMY, JACQUES (1588–1672)

Grandamy was a physicist and astronomer, described, by contrast to **Mesland** and **Vatier**, who were far more positively disposed to Descartes' **philosophy**, as among those **Jesuits** who only "sampled" it, or who only praised his good intentions and efforts, without going any further. He was the inventor of a nonmagnetic needle received by Descartes through **Mersenne**. As the rector of the Collège de La Flèche, he was a correspondent of Descartes, also conveying to him important letters from Mesland. He was the recipient, among other Jesuits, of a copy of the newly published *Principles of Philosophy* when Descartes briefly returned to Paris in 1644.

See also Jesuit; Mesland, Denis; Vatier, Antoine

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THOMAS M. LENNON

GRAVITY

Descartes' theory of gravity, which is an integral component of his **vortex** theory of planetary **motion**, proved to be one of his most important contributions to natural philosophy in the early modern period. The "Cartesian" account, which includes the many hypotheses adapted from Descartes' views by later Cartesians, was the dominant theory of gravity toward the end of the seventeenth century, especially on the European continent (see **Cartesianism**). However, Cartesian gravity subsequently relinquished its leading role to **Newton's** theory, and by the mid-eighteenth century it had largely been abandoned.

At the beginning of the seventeenth century, the Aristotelian-based Scholastic **explanation** of gravity still held sway among natural philosophers, an account that categorized "heaviness" as a substantial form – that is, as a sort of internal, goal-oriented property of a **body** (see **form**, **substantial**). In the Sixth Replies, Descartes acknowledges that he had earlier accepted a similar view of gravity, an account that he now criticizes as falsely derived from the mental properties of the human **mind**: "What makes it especially clear that my **idea** of gravity was taken largely from the idea I had of the mind is the fact that I thought that gravity carried bodies towards the centre of the earth as if it had some knowledge of the centre within itself. For this surely could not happen without **knowledge**, and there can be no knowledge except in a mind" (AT VII 442, CSM II 298). Descartes developed his mechanical explanation of gravity, which relies only on the **extension** and motion of bodies, in large part to counter this misleading conception. As he claims in *The World* (1633), all of the "forms of inanimate bodies can be explained without the need to suppose anything in their matter other than **motion**, size, **shape**, and arrangement of its parts" (AT XI 25–26, G 18).

Starting with his early work, *The World*, and developed in much greater detail in his major scientific work, *Principles of Philosophy* (1644), Descartes' account of gravity is presented as a consequence of his vortex theory of planetary motions. A vortex is a large band of material particles that circle a sun, with each vortex constituting a solar system and with its planets situated at different locations within the vortex. In Descartes' matter-filled universe (or **plenum**), planets are carried along by a vortex and are usually at rest relative to the particles that make up different parts of the vortex, with these different parts of the vortex moving at different speeds that correlate with the planets observed motion. Leaving aside the macroscopic tertiary matter, the minute material particles that comprise vortices are either the indefinitely small primary matter, which is the debris left over from the fracture of larger elements, or the atom-sized, globule-shaped secondary matter (see **element** and **subtle matter**) (AT VIIIA 62–66). In short, Descartes' vortex theory attempts to provide a comprehensive explanation of all cosmological phenomena by means of a mechanical model

of interaction that is limited to the motions, collisions, and contact pressures of bodies and minute particles, and which rejects any distinction between a celestial and a terrestrial region (i.e., above and below the orbit of the moon, a separation that was upheld in Scholastic science). The different elements of matter in conjunction with Descartes' three **laws of nature** are thus the means by which all cosmological phenomena are explained, and that includes both the free fall of bodies on the surface of the earth and the orbits of the planets around the sun – that is, gravity.

To understand the phenomena of gravity, therefore, it is important to examine Descartes' first and second laws of nature. Whereas the first law states “that each thing, as far as is in its power, always remains in the same state” (AT VIIIA 62, MM 59), the second law describes the paths of those bodies that persevere in the same state of motion. In his explanations and diagrams, Descartes frequently employs the example of a stone suspended in a rotating sling, and his account makes it clear that the straight-line paths covered by the second law are directed radially outward from the center of the sling's circular motion: “All movement is, of itself, along straight lines; and consequently, bodies which are moving in a circle always tends to move away from the center of the circle which they are describing” (AT VIIIA 63, MM 60). Therefore, the outward tug that the rotating sling exerts on the person is a direct result of this “center-fleeing” **force** covered by the second law, a force later dubbed “centrifugal.” More carefully, he explains “that any body which is moving in a circle constantly tends to move [directly] away from the center of the circle which it is describing. Indeed, our hand can even feel this while we are turning the stone in the sling, for it pulls and stretches the rope in an attempt to move away from our hand in a straight line” (AT VIIIA 65, MM 61).

In the celestial vortices then, it is thus the center-fleeing tendency or strivings of all bodies, of both the vortices' constituent particles and the planet, that account for phenomena that Newton's **physics** would describe using the term “gravity.” As described in *Principles* III, a planet remains at rest in its vortex – that is, undergoes no radial translation toward or away from its central star – if the outward-directed tendency of the planet (described by the second law) is in balance with the same tendency of the particles that constitute that part of the vortex, all predicated on a complex relationship involving the speed and size of both the vortex's particles and the planet. If the planet has a center-fleeing tendency different from the elements that compose the portion of the vortex, then there are two possibilities: (i) if the planet's outward striving is greater than the constituent particles' strivings, then it will move outward to a part of the vortex farther away from the sun; or (ii) if the planet's outward striving is lesser than the constituent particles' tendencies, it will move down to a part of the vortex closer to the sun. It is this last situation, when the planet descends, that accounts for the phenomenon of gravity, or “heaviness.” As Descartes describes it: under scenario (i) the planet

would there find itself surrounded by slightly smaller heavenly globules [secondary matter] which it would exceed in force to recede from the center around which it revolves ... causing it to ascend. If, on the other hand, [under (ii)] it receded further from the Sun, it would encounter there heavenly globules which were somewhat less rapidly moved and would thus decrease its agitation [center-fleeing force], and which were slightly larger and would thus have the force to drive it back toward the Sun. (AT VIIIA 192, MM 169)

Finally, the vortex particles that surround the earth account for the phenomena of gravity in the same manner: "The force which the individual parts of the heavenly matter have to recede from the center of the earth cannot produce its effect unless, while those parts are ascending, they press down and drive below themselves some terrestrial parts into whose places they rise" (AT VIIIA 213, MM 191).

Overall, one of the main advantages that Descartes' account of gravity possessed, especially when compared with its future Newtonian rival, is its sheer simplicity: inertial motion (i.e., nonaccelerating rectilinear speed), as treated in the first and second laws, explains all Cartesian physical phenomena, including gravity. Newton, on the other hand, had additionally to posit an unknown quality of attraction among bodies, which his critics charged was tantamount to an "occult" quality. Nevertheless, Newton's theory was both mathematically and empirically superior, for Descartes put forward no quantitative formulation of his theory by which predictions could be calculated and tested. Likewise, as Descartes' theory gained more scrutiny over the years, its internal inconsistencies became more apparent, and what few empirical predictions the theory made failed to be confirmed, thus ultimately bringing about its demise.

See also Earth, Motion of the; Element; Explanation; Force and Determination; Law of Nature; Motion; Newton, Isaac; Subtle Matter; Vortex

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HABIT

In the *Nicomachean Ethics*, Aristotle famously says that virtue is a *hexis*. This term, which comes down to us from the Latin *habitus*, is often transliterated in English as “habit,” though some commentators note that Aristotle is claiming that virtue is something active requiring attention, practice, and reflection, whereas the word “habit” suggests something passive and involuntary. Descartes’ use of the term *habitus*, or *habitude* in French, is more complex. He sometimes uses it to refer to our natural dispositions or to ones that we formed in childhood prior to being in full possession of our reason. Typically, these are vicious habits that Descartes encourages us to overcome by replacing them with virtuous ones, but unlike the former the latter must be actively cultivated. Habits play a prominent role in two aspects of Descartes’ philosophy: his account of **happiness** and **virtue** on the one hand and his epistemology on the other. What follows is a separate discussion of each.

1. VIRTUE AND HABITS

Although Descartes often treats habits as obstacles to the search after **truth**, habits are instrumental and essential to living a virtuous and happy life. Descartes’ treatment of habits within his moral psychology and **philosophy** is developed most fully in his final work, *Passions of the Soul* (1649). There, Descartes explains that humans are a union or composite of **mind** and **body**, and **passions** are **modes** of this union (see **human being**). Passions and actions that promote the preservation of the union are virtuous and good, and those that harm the union are bad. Because humans cannot directly arouse or suppress passions or directly will the body to move, they must do so indirectly by means of representing things that are joined to certain passions (*Passions* I.45). The joining of particular ideas to particular passions results from habit – a disposition to act in a certain way that is acquired by nature or by repetition. Thus, habit formation is a key ingredient in the training and guiding of our actions. In the pursuit of happiness, habits serve as the mechanism for regulating our passions – instituting the right idea-passion couplings (by nature or repeated experience) that produce beneficial actions.

Descartes gives examples of good habit formation and bad habit formation. A good habit is one that couples the action of the will and its representational content (an intention) with the particular pattern of **animal spirits** coursing through the brain and body, and thereby brings about a beneficial action. For example, the meaning of the spoken word is learned following a process of habituation when certain sounds produced by patterns of moving animal spirits in the body and brain are conjoined with certain intentions in the mind. Habit is a process of

repetition of these couplings and the establishment of an experiential connection between sounds and the meanings they embody (*Passions* I.44). A bad habit is one that couples the action of the will and its representational content with a particular pattern of animal spirits in the brain and body, and thereby brings about a harmful action. For example, wonder becomes “blind curiosity” when unchecked and habituated. Descartes describes excess wonder as a “disease whose victims seek out rarities simply in order to wonder at them and not in order to know them” (*Passions* I.78). The remedy to excessive wonder is to habituate determinate **judgments** on the basis of figuring out which passion-idea pairs will lead you to the “right,” as in most useful objects in the preservation of the union. Vicious action consists in the misuse of the passions – allowing the soul to be ruled by passions that lead us to harmful objects.

Human virtue, vice, and weakness are not conceptualized, on Descartes’ account, as a war between **reason** and emotion, or between appetite and the will, but rather between conflicting passions. Virtues are good habits of the soul that dispose it to do good things that are within our power (AT IV 276, CSMK 261). It is not the triumph of reason but rather the proper guidance and training of the passions that lead us to the good life. Whereas habits in the intellectual realm must be overcome in the search after truth, in the practical realm habits must be properly instituted to regulate the passions in the pursuit of happiness.

2. KNOWLEDGE AND INTELLECTUAL HABITS

Within Descartes’ epistemology, the notion of a habit is closely related to the notion of a philosophical **prejudice** or (as translated in CSM) preconceived opinion. A prejudice is an opinion that is accepted without sufficient reason and that one continues to affirm out of habit. Descartes maintains that philosophical prejudices, such as the false **judgment** that colors exist on the surfaces of objects or that the earth is flat, are usually formed in our earliest childhood, before the age of **reason**, or as a result of being indoctrinated in **Scholasticism**. But once they become habituated we lose sight of the fact that they are groundless, or that we are even making them, and we take them to be “known by the senses or implanted by nature, and ... utterly true and evident” (AT VIIIA 35–36, CSM I 219). Among our intellectual habits, the most widespread and pernicious is the tendency to conceive of all things using sensory images and, in so doing, to confuse the ideas of **mind** and **body**.

All our ideas of what belongs to the mind have up till now been very confused and mixed up with the ideas of things that can be perceived by the senses. This

is the first and most important reason for our inability to understand with sufficient clarity the customary assertions about the soul and God. (AT VII 131, CSM II 94)

Descartes holds that metaphysical ideas can be understood only through the pure **intellect**. The **method of doubt** is designed to help the meditator detach from the senses so that she may clearly and distinctly perceive such ideas. But Descartes maintains that our habits tend to be highly entrenched, especially the habit of conflating the ideas of mind and body. For this reason, “protracted and repeated study is required to eradicate the lifelong habit of confusing things related to the intellect with corporeal things, and to replace it with the opposite habit of distinguishing the two” (ibid.). The meditator grapples with this habit in the Second Meditation, in the context of the proof that he is a thinking thing (*res cogitans*). Having proved that he exists, the meditator then asks, “What am I?” In order to answer this question, Descartes suggests that one start from one’s prephilosophical conception of oneself. One formerly regarded oneself as a combination of a body and a soul but conceived of the soul as a tenuous corporeal **substance**, “like a wind or fire or ether, which permeated my more solid parts” (AT VII 26, CSM II 17). In other words, prior to philosophizing, one conceives of the soul in corporeal terms, in keeping with the vicious habit described previously. By applying the method of doubt to this former conception, the meditator discovers that she can be certain only that she is a thinking thing (devoid of any corporeal properties). This result goes some way toward teasing apart the ideas of mind and body, but it is not until the sixth and final meditation, in the context of proving real **distinction**, that the meditator discovers that these ideas can be mutually excluded from one another (see **abstraction versus exclusion**). Thus, one of the main goals of the *Meditations* as a whole is to replace the reader’s habit of conflating the ideas of mind and body with the more virtuous habit of distinguishing the two. Descartes’ defense of **dualism** hinges on this result.

See also Happiness, Judgment, Method, Prejudice, Reason, Virtue

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HAPPINESS

The English term “happiness” is a translation of the Latin *felicitas* (AT X 361, CSM I 10; AT VII 52, CSM II 36) and its French equivalent *félicité*, as found in Descartes’ writings, especially in the **correspondence** with **Princess Elisabeth**. This notion is the same as “blessedness,” which appears frequently beginning with Descartes’ comments on Seneca’s *De vita beata* (AT IV 263, CSMK 256–57). Happiness in the sense of *félicité* is distinct from the fortuitous occurrence of being happy (*bonheur*) insofar as the former depends not on chance or good fortune but rather on us alone (AT IV 264, CSMK 257).

The notion of *félicité* is linked to that of satisfaction (*contentement*) since Descartes defines it as the perfect satisfaction of **mind** resulting from the possession of the “sovereign good for us” (AT IV 264, 275, 277, 305, CSMK 257, 261, 261–62, 268; AT V 81–86, CSMK 324–26). Although far more rarely, Descartes also uses the notion of voluptuousness or pleasure in order to indicate what this deeper happiness (or “beatitude”) consists in (AT X 361, CSM I 10; AT VII 52, CSM II 36; AT IV 276–77, CSMK 261).

Finally, Descartes’ reflections on happiness remain within the framework, inherited from **Scholasticism**, of the distinction between natural and supernatural beatitude (AT VII 52, CSM II, 36; AT IV 267, 285, 314, CSMK 258, 264, 272; AT V 82, CSMK 324). While Descartes concentrates exclusively on the happiness naturally available to man, he recognizes that there is another and higher happiness that does not fall within the domain of philosophical thought.

Descartes broaches the topic of happiness in his early writings, but it is only with the **correspondence** with Elisabeth in 1645 that a sustained reflection on the question is begun and that a particularly Cartesian doctrine begins to be elaborated that will be completed in the *Passions of the Soul* (1649). The various allusions to human happiness that precede the correspondence are in fact brief, marked by borrowings and shifts: in the *Rules* Descartes affirms that happiness consists in the contemplation of **truth**, in a veiled reference to the theoretical happiness inspired by Aristotle (AT X 361, CSM I, 10). A similar concept is found in the *Meditations*, this time inserted into a gradation of which the beatific vision of theologians is the summit: “For just as we believe through faith that the supreme happiness of the next life consists solely in the contemplation of the divine majesty, so experience tells us that this same contemplation ... enables us to know the greatest joy of which we are capable in this life” (AT VII 52, CSM II 36). In the *Discourse on Method*, by contrast, Descartes evokes through the third maxim of his provisional morality a concept inspired by Stoicism, according to which happiness is founded on the mastery of one’s desires, so we are not ruled by happenstance (AT VI 26–27, CSM I 124). When the correspondence with Elisabeth begins, Descartes relies at first on what

the ancients have written, “in order to make up for the defects of my mind, which can produce nothing on its own” (AT IV 252, CSMK 256). He then comments on the *De vita beata* of Seneca. However, in the next letter, he judges that Seneca does not treat the question as he ought to have done (AT IV 263, CSMK 256–57), and he moves away quickly from this text in order to develop his own thought (AT IV 290–91, CSMK 265). This reflection on happiness leads Descartes to develop a theory of the **passions**, which finds its expression in the *Passions*, his last written work. In effect, these are the passions that attach us to fortune and that threaten to enslave our contentment. The question of happiness is thus the impetus that explains the last phase of the development of Cartesian thought, in the last four years of his life.

How does the reflection on beatitude relate to Descartes’ **philosophy** as it was constituted up until 1645? First, having chosen to engage Elisabeth about the way philosophy can render the soul happy despite misfortune (AT IV 252, CSMK 256), Descartes places himself in the lineage of the Stoics, whose concept of happiness he first evoked in the *Discourse*. Second, the specifically Cartesian reflection on happiness begins in a letter of August 4, 1645, by enunciating the moral rules that are clearly a reformulation of the provisional morality’s maxims. This reformulation bases the precepts of morality on **reason**. It is made possible because the search for a sure foundation for **knowledge** has been completed in the *Meditations*. These rules provide the means to make us content by ourselves, “without any external assistance” (AT IV 265, CSMK 257).

Descartes is thus able to formulate the initial elements of a morality founded on reason and his doctrine of happiness. Happiness results from acting rationally, that is to say, from **virtue**. In a letter of September 15, 1645, Descartes explains how the chief truths of **Cartesianism** constitute means to “strengthen one’s understanding so as to discern what is best in all the actions of life” (AT IV 291, CSMK 265). He makes clear the moral utility of the demonstration of **God’s existence**, of the substantive distinction between soul and **body**, of the limitlessness of the universe, and of a third principle, enunciated here for the first time, according to which the individual must prefer not himself individually but the whole of which he is a part. These four truths must lead us to consider that it is not rational to seek external goods. They show us that sovereign good is within us.

But a difficulty remains here since Descartes admits that the will is not bound to conform to what reason shows it to be good (AT IV 173–75), and that the arguments of reason clash with impulses of the passions, which carry more weight: “Often passion makes us believe certain things to be much better and more desirable than they are” (AT IV 284, CSMK 263–64).

Descartes solves this problem by appealing to the doctrine of “generosity” that he sets forth in the *Passions*, part III. *Générosité* is a passion, that is to say, it is a representation that increases in our eyes the greatness of the good to which it tends, a

good that is already by itself the greatest that we can possess (the proper use of our **free will**). This passion is thus stronger than all the other passions; it is therefore the general remedy against the passions (AT XI 447, CSM I 385). That is why its definition includes not only the knowledge of what is our highest perfection but also “the firm and constant resolution” to make proper use of our wills, by which we actually possess this perfection:

True generosity, which causes a person’s self-esteem to be as great as it may legitimately be, has only two components. The first consists in his knowing that nothing truly belongs to him but this freedom to dispose his volitions.... The second consists in his feeling within himself a firm and constant resolution to use it well – that is, never to lack the will to undertake and carry out whatever he judges to be the best. To do that is to pursue virtue in a perfect manner. (AT XI 445–46, CSM I 384)

Thus, those who are generous attain perfect happiness in this life.

The principal characteristic of this doctrine of happiness based on virtue is found in the space given to the passions, where Descartes distinguishes his view from Stoicism, his initial inspiration. Not only does he judge that *générosité* can be a passion as well as a virtue (AT XI 454, CSM I, 388), but he also assimilates the “fresh satisfaction we gain when we have just performed an action we think good” to a passion, namely to a sort of joy, the sweetest of all “because its cause depends only on ourselves” (AT XI 471, CSM I, 396). Descartes’ conception of happiness is thus shown to be profoundly human in that it involves a participation of the body in virtue and contentment of the soul that it produces. In that respect, his conception of happiness shows itself to be deeply human since it implies a participation of the body in the virtue and contentment of the soul that it produces.

See also Free Will, Passion, *Passions of the Soul*, Reason, Virtue

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LAURENCE RENAULT

HARVEY, WILLIAM (1578–1657)

Harvey was born in Folkestone, Kent, probably on April 1. He studied arts and medicine at Cambridge from 1593 to 1599, before going to Padua where he received his M.D. in 1602, mainly under Hieronymus Fabricius of Aquapendente. In 1604 he married Elizabeth Browne with whom he had no children. In 1607 he was elected a Fellow of the Royal College of Physicians, London. From 1609 to 1643, he was a practicing physician at St. Bartholomew's Hospital. The Lord Chancellor, **Francis Bacon**, and the Earl of Arundel were among his private patients. From 1615 to 1656, he acted as professor and demonstrator in anatomy and surgery at the Royal College of Physicians. From 1616 onward, almost biannually, Harvey gave a series of Lumleian Lectures on which his *Universal Anatomy* manuscript was based. He was court physician to both James I and Charles I and dedicated his epoch-making *Anatomical Exercise on the Motion of the Heart and Blood in Animals* (1628) to the latter. During the 1630s he traveled widely throughout Europe. In 1642, during the Civil War, while he attended King Charles, he lost a great deal of written work when Parliamentary troops ransacked his house in Whitehall. In 1651 his second major opus was published as *Anatomical Exercises on the Generation of Animals*. Harvey died a widely honored man on June 3, 1657.

Harvey's singular discovery of the one-way circulation of the blood during the early 1620s was the final result of a comprehensive flash of insight combined with decades of painstaking anatomical and physiological investigations. At Padua, Fabricius had demonstrated the newly emerged valves in the veins under his student's very eyes. Fabricius's short illustrated treatise *On the Valves of Veins* (1603) is of interest here for understanding Harvey's mental struggles and blockades. Fabricius contended that two-way valves diminish the speed of the blood in the veins to prevent the pooling up of nutritive blood in the extremities. He agreed with Galen's long-standing idea that venous blood flows from the liver to the whole fabric of the **body**. In his first Lumleian Lectures of 1616, Harvey still endorsed this view, noting that "the valves set in contrary direction break off the pulse both in the **heart** and in the other veins" (1964, 273).

It took Harvey several more years to come to the insight that the venous valves face *toward* the heart, thus preventing poor blood from flowing back to the periphery. This change of the direction of venous blood, combined with the knowledge that rich arterial blood always flows into the veins and never the other way around, constitutes the kernel of the circuitous flow of the blood. Powerful arterial blood is spouted from the left chamber into the aorta from where it spreads throughout the body. Via invisible *capillaries* or hair-vessels, effete blood is collected in the veins and sent through the venae cavae to the right heart. From there this blood speedily flows via the lungs to the left heart in which it is vivified and made nutrient.

Harvey's momentous discovery was attacked by James Primerose (1630), Caspar Hofmann (1636), and Johann Vesling (Padua), but was fully adopted in Holland by **Van Beverwijck** and Walaeus (1640). Descartes (ca. 1632) accepted the principle of the circulation but stuck to his own conceptions of the **motion** of the heart (see **heart**). Riolan (the Younger) of Paris, in his anatomical publication the *Encheiridium anatomicum et pathologicum* (Paris, 1648; Leiden, 1649), dismissed Harvey's position, believing only in partial circulations and still wanting to follow the traditional Galenic views. To this polemic Harvey answered with his *Two Anatomical Exercises on the Circulation of the Blood addressed at Johannes Riolanus, son, in Paris* (1649). In the second of these scholarly letters, he also gently corrected Descartes' erroneous **explanation** of the movement of the heart.

See also Beverwijck, Johannes Van; *Description of the Human Body*; Heart

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WILLEM VAN HOORN

HEART

From the fourteenth to the seventeenth centuries, widespread attention was paid to the heart and blood in courtly love, mysticism, alchemy, prose, and poetry. In the Aristotelian tradition, the heart was also considered as a mediator between soul and **body**. The anatomy and function of the heart were very important to Descartes from the *Treatise on Man* to his last work on the *Passions of the Soul*. The anatomical heart of three dimensions appeared late on the stage of medical **knowledge**. During the sixteenth century, Vesalius, Fabricius of Aquapendente, and Cesalpino investigated the heart and the **motion** of the blood, but no undisputed results followed from their endeavors. Columbus and Servetus described the lesser transit of venous blood through the lungs but necessarily stopped short of understanding the systemic circulation of the blood. The pulmonary and systemic circulations are part of the *total* circulation and only intelligible from **William Harvey's** later decisive viewpoints (Pagel 1967, Bitbol-Hespériès 1990, Van Hoorn 2011).

In Harvey's epoch-making *On the Motion of the Heart and Blood* (1628), the total one-way circulation of the blood is related to the extraordinary position and purpose of the heart. Using the well-known **analogy** of macro-microcosm, Harvey (1628, 42) states: "The heart is the beginning of life; the sun of the microcosm, even as the sun in his turn might well be designated the heart of the world." In short, contrary to Galen, it is the swift contractions of the left chamber that spout nutrient blood into the aorta from where the various parts of the body are quickened and alimented.

We now turn to the relationship between Harvey and Descartes on matters of the heart. From the end of the 1620s, Descartes was reading and experimenting in anatomy. **Mersenne** was abreast of what Descartes was doing and discussed Harvey's publication with him. No later than 1632 he had read it and accepted Harvey's discovery of blood circulation. But he stuck to his own interpretations of the motion of the heart.

In Descartes' view, the heart is the hottest part of the body that through ebullition turns cold blood almost into a vapor. In the then-unpublished *Treatise on Man* (ca. 1630–32), he extensively dealt with the operations of the heart: "The flesh of the heart in its pores contains one of those fires without **light**, which makes it so hot and so fiery that when some blood enters into one of its chambers it quickly distends

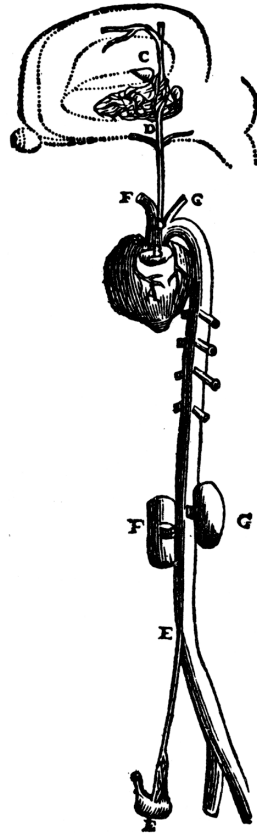


Figure 11. Brain and heart (*Treatise on Man*, 1664).

and dilates.... The fire in the heart ... serves no other purpose than to dilate, warm up and refine the blood, which continually falls drop-by-drop ... into the right or the left chamber” (AT XI 123, G 101) (see Figure 11). Descartes assumed that the heart contains an inherent heat. He explains the action of the heart as follows. When two drops of blood enter both chambers of the heart, these immediately rarify and extend into a *space* that is much larger than the space these fluids occupied before. The heated up blood forces open the valves to both the pulmonary artery and aorta, thus causing the expansion of the heart and the arteries at the same time. In short, the heat of the heart brings the blood almost to the boiling point, and hot blood occupies more space than cold blood. The expansion of the heart or its diastole, contrary to Harvey, forms its motor function. However, Descartes followed Harvey in stating: “The motion of the blood in the body is only a perpetual circulation” (AT XI 127, G 104).

These ideas were published posthumously first in a Latin translation of the *Treatise* in 1662 and then in their original French in 1664, together with the

Description of the Human Body (under the title “Treatise on the formation of the foetus”), in which Descartes further develops his positions about Harvey’s theory. Besides ebullition, fermentation of the blood became an explanatory principle.

Descartes’ work on the heart, the veins, and the arteries, as well as his partial agreement with Harvey, was first made public in the *Discourse on Method* (Leiden, 1637). Here there are nine pages in the fifth part, which can serve as a summary of Descartes’ lifelong work on the subject (AT VI 46–56, O 37–45). Descartes starts with his unshakable conviction: the heart is always warmer than any other part of the body. It should be noted here that the only arguments for his position are that all people are in agreement on this point and that you can feel it with your fingers. These are rather unusual arguments in his works.

There follows an **explanation** of the motion of the heart along the lines of the account in the *Treatise on Man*, as just described. Two drops of cold blood will fall into the hot chambers of the heart up to only two hundred times per day. These are immediately heated up and cause the simultaneous expansion of heart and arteries. In technical terms: it is the expansion-diastole and not Harvey’s contraction-systole that forms the motor function of the heart (Gilson 1930, Canguilhem 1955). For the discovery of the circulation of the blood Descartes gives the honor to Harvey with an explicit reference to his 1628 treatise. However, he is well aware of his divergent position with regard to the diastolic motor function of the heart. After praising Harvey he continues with more “proofs” that his conception is the only right one.

Descartes’ discussion of the origin and function of the **animal spirits** shows further why he does not conceive of the heart as a muscle, contrary to Vesalius and Harvey. The animal or psychical spirits are mainly borrowed from Fernel’s physiology (1567; Aucante 2006, 231; AT XI 130, G 106). These material spirits are produced in the heart and consist of the finest, hottest, and lightest particles of the blood. They are sent directly to the brain from where they inflate the muscles for contraction via the hollow nerves. If the heart were a muscle it would receive the spirits for its contraction and produce them at the same time. Descartes carefully avoided this inconsistency. A few decades after Descartes’ death, Jan Swammerdam experimentally demonstrated that a muscle does not increase its volume when stimulated, thus refuting the Frenchman’s views. To summarize, the notions of the hot fire without light, the drop-by-drop filling of the chambers, the production of the animal spirits, and the diastolic motor function of the heart are the unique features of Descartes’ theory of the circulation of the blood (Aucante 2006).

In his *Second Letter to John Riolan (The Younger)* (1649), Harvey subtly undermines Descartes’ exchange of the systolic and diastolic functions of the heart and rejects his notion of the animal spirits. The heart is not a heated kettle, it is not the hottest part of the body, and it does not possess an innate heat (*calidum innatum*). In fact, the blood itself is the hottest element, and there is thus no relationship possible between an innate heat and the production of animal spirits in the heart.

There is no drop-by-drop filling of the heart some two hundred times per day but an incessantly filling and discharge of some fifty thousand times per day (Harvey 1628, ch. 9). Descartes had stated that when the heart erects, it expands, and the ventricles consequently become more spacious. This is not the case. The erect heart is smaller in every dimension and is thus not in diastole- but in systole-contraction. Descartes' spatial and thermic explanation of the motion of the heart is based on incorrect observations and assumptions. Despite his quarrels with Harvey, Descartes' repeated public recognitions of Harvey's discovery of the blood circulation have contributed to its acceptance in philosophical and medical circles.

See also Anatomy and Physiology; Animal Spirits; *Description of the Human Body*; *Discourse on Method*; Explanation; Harvey, William; Medicine; *Passions of the Soul*; Rarefaction and Condensation; *Treatise on Man*

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WILLEM VAN HOORN

HEEREBOORD, ADRIAAN (1613–1661)

Heereboord was born in Leiden, where he studied philosophy and theology at the university and, in 1640, was appointed reader in logic there. In 1642 he also became

deputy dean of the Statencollege (a theological college for bursars of the States of Holland and Holland townships), the dean being Jacobus Revius (1586–1658), a very orthodox theologian, vehemently opposed to Cartesian **philosophy**. Heereboord's main task in the college was to train the students by organizing disputes on philosophical questions. From 1644 on he was *ordinary* (full) professor in philosophy. Heereboord did not have an easy life. The sordid details of his married life, mostly related to his drinking habits, were spelled out in several pamphlets by his brothers-in-law, Jan (1622–60) and Pieter de la Court (1618–85), also known as political theorists. The ecclesiastical authorities constantly intervened to prevent a permanent separation.

From the beginning of his professional career Heereboord was critical of Aristotelianism, by which he meant the slavish following of Aristotle. His own position was in all respects eclectic, also as far as modern philosophers were concerned. In fact, he believed that the **method** of philosophy consists in confronting different ideas instead of commenting on the works of a single author. This caused him to embrace Descartes' work as a useful contribution to philosophy, barely a few weeks after having defended the notion of **substantial forms** against **Regius** (1598–1679). However, apart from the fact that he scrupulously avoided issues that could undermine orthodox reformed theology, what one finds in his works and disputations is a provocative defense of isolated ideas and propositions of Descartes (such as “*cogito, ergo sum* is the first **certainty** of philosophy” or “**doubt** is the beginning of a philosophy not subject to doubt”) rather than a systematic rethinking of the Cartesian project as a whole. On the other hand, he was one of the few Dutch Cartesians to tackle metaphysical problems, in defiance on the official ban on metaphysical teaching issued by the Leiden administration. Actually, it is difficult not to believe that some of Heereboord's enthusiasm for Descartes was motivated by his troubled relations with Revius. This lack of fundamental commitment seems to be confirmed by the fact that he edited or reedited several more traditional works, such as a textbook on logic by Franco Burgersdijk (1590–1635) and a perfectly orthodox and traditional *Metaphysica* by the Franeker professor of theology Johannes Maccovius (1588–1644). The traditional format of his writings as well as his religious orthodoxy proved attractive even outside the United Provinces – some of his works were reprinted at Oxford and Cambridge.

The first time Descartes mentions Heereboord is indirectly in a letter to **Pollot** at the beginning of 1644, where he writes that a Leiden professor of philosophy “declares himself more openly for me and cites me with more praise than Regius ever did.” The fact that a few months earlier the same professor still defended the substantial forms he explains away by claiming that this had been done only to keep up appearances (AT IV 77–78). Previously Heereboord had been present at a meeting between Descartes and Comenius (1592–1670) in 1642. Heereboord was the editor of the first edition of the *Comments on a Certain Broadsheet* (1648), to which

he added a preface in which he detailed his own grievances – it is not clear how he came by the manuscript of the *Comments*, given the fact that the publication seems to have been realized against Descartes' will. Eventually, Descartes may have had his doubts about Heereboord's usefulness as an ally.

See also Calvinism; *Cogito Ergo Sum*; *Comments on a Certain Broadsheet*; Method; Regius, Henricus

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THEO VERBEEK

HOBBS, THOMAS (1588–1679)

Hobbes was an elder contemporary of Descartes and a member of **Mersenne's** circle after he fled to Paris (1640) in anticipation of the English Civil War. Hobbes composed the Third Objections to Descartes' *Meditations* and made a close study of Descartes' *Dioptrics* after having been sent a copy of the *Discourse on Method* in 1637 by **Sir Kenelm Digby**. Criticisms of this work were taken up by Hobbes in a Latin optical treatise in the late 1630s. They were also summarized in a lost letter of 1640 from Hobbes to Mersenne. Echoes of these criticisms are noticeable in letters between Descartes and Mersenne in 1641. Although Hobbes is sometimes claimed to be, like Descartes, a philosopher interested in the refutation of skepticism

(Popkin 1979; Tuck 1988, 1989), there is very little textual or other evidence for this interpretation (Sorell 1993), and the main common ground between them is a strong anti-Aristotelianism. Hobbes's earliest full-length philosophical treatise, *The Elements of Law* (1640), contains a strong attack on the Aristotelian theory of sense perception, and the political philosophy for which Hobbes is best known today is a wholesale rejection of Aristotle – from the definition of man as a political animal, to the idea that citizenship is exercised through deliberation and **judgment**, to the idea that what Aristotle calls “tyranny” is a perversion of kingship.

The most sustained engagement between the two philosophers comes in Hobbes's mostly uncomprehending Third Objections to the *Meditations* and Descartes' mostly exasperated Replies. Hobbes's two main targets – which probably reflect his preoccupations when he criticized the *Dioptrics* – are Descartes' immaterialism and (as Hobbes thinks) traditionalism. Hobbes approves of the *cogito* but disagrees strongly with its corollary: that the “I” designates a thinking thing (AT VII 172–73, CSM II 122). Hobbes first accuses Descartes of being confused in speaking interchangeably about a thinking thing and an “**intellect**” or “**reason**.” There are no such *things or substances* as intellects, Hobbes thinks, only acts or powers of intellection on the part of subjects (AT VII 172–73, CSM II 122), and, for all Descartes shows, subjects are corporeal. Indeed, Hobbes adds, the lesson of the **wax** argument in the Second Meditation is that *whatever* undergoes change is a **body** (AT VII 173, CSM II 123), so that Descartes is inconsistent when he claims that the “I” of the *cogito* is incorporeal.

This line of argument shows that Hobbes misunderstands not only the wax argument but also the upshot of the First Meditation. At the beginning of the Second Meditation, belief in the **existence** of bodies has been suspended, and yet this does not seem to make the *cogito* unthinkable: on the contrary, the “I” and its thinking are possible subjects of reflection, and the *cogito* is quite certain. But if the *cogito* seems certain when the existence of bodies does not, then the nature of the thing that thinks cannot even tentatively be supposed to be corporeal. Descartes is not certain that the “I” is incorporeal, either, in the Second Meditation. The idea that the “I” is a thinking thing awaits full endorsement until the Sixth Meditation. There are more doubts about Descartes' immaterialism from Hobbes in the Third Objections, but none notably more potent than the one just examined (Sorell 1995, 86ff.).

Hobbes's second line of attack is on the traditionalism of the *Meditations*. “I am sorry that the author, who is so outstanding in the field of original speculations, should be recycling this ancient material [on the unreliability of the senses]” (AT VII 171, CSM II 121). This is further evidence that Hobbes does not see the novelty of the **method** of **doubt**, and in other places Hobbes is taken in by the facade Descartes erects for the doctors of the Sorbonne, accusing him of falling back on Scholastic ways of talking (see, e.g., AT VII 185, CSM II 230), for example, when Descartes invokes the doctrine of the degrees of reality of substances in the Third

Meditation (see **being, formal versus objective**). There is a connection for Hobbes between immaterialism and **Scholasticism**: both take away from effective **explanation**. Immaterial things are unnecessary to invoke for explanatory purposes when bodies are available, and traditionalism is an invitation to **language** that strictly does not make sense, or that loads explanations with occult entities.

Hobbes's biographer, John Aubrey (1975 [1680], 168), reports Hobbes as saying that had Descartes "kept himself to **Geometry**, he had been the best geometer in the world, but that his head did not lye for philosophy." This remark has received more than one interpretation (see, e.g., Sorell 1995, Duncan 2005). It makes sense if one attributes to Hobbes and Descartes different conceptions of **philosophy**, and especially of first philosophy. For Hobbes, philosophy consists of any reasoning that systematically increases **knowledge** or probable belief about **causes** and effects for human benefit (cf. *De corpore*, ch. 1). Hobbes's un-Aristotelian philosophy of science and logic constrain that reasoning to agree with a kind of nominalism and materialism. Philosophy is not knowledge of **essences**; **sylogisms**, including those used in scientific demonstrations, are concatenations of universal propositions, which are in turn concatenations of universal names. There are no essences, and no knowledge of essences of kinds (not even through propositions concatenating universal names), but only knowledge correlating different classes of **motions** of different bodies to different classes of effect.

Since for Hobbes the knowledge of effects does not depend on knowledge of **God**, there is no branch of philosophy that demonstrates the systematic dependence of effects on God or the dependence of systematic knowledge of effects on knowledge of God. There is no room, in short, for Cartesian first philosophy within what Hobbes calls "philosophy." Hobbes's prior attachment to a restrictive conception of philosophy may explain why, as an objector to the *Meditations*, he tends to focus on passages in which Descartes appears to turn unnecessarily from the small explanatory apparatus of motion, matter, **imagination**, and the concatenation of names, to one that adds immaterial substances. Hobbes seems unable to understand the underlying Cartesian conception of philosophy other than as a kind of warmed-over Scholasticism.

Hobbes's low opinion of Descartes as a philosopher was reciprocated. The evidence is not only to be found in the tone and content of the Third Replies. In letters to Mersenne in 1641, Descartes repeatedly dismisses Hobbesian criticisms of his **optics** and claims of priority in certain elements of optical theory (AT III 320, CSMK 173; AT III 354, CSMK 178). Descartes does seem to have conceded (in a letter speculatively dated by **Clereslier** to 1643: AT IV 473, CSMK 230–31) that Hobbes's *De cive* (1642), a version of his political philosophy, showed him in a better intellectual light than his writings as a would-be metaphysician or physicist. But Descartes entirely repudiates the content of Hobbes's politics, criticizing it for supposing that men are wicked or giving them a pretext to be wicked. There is no sign

of a Hobbesian influence on the few scraps of political philosophy to be found in Descartes – in the **correspondence** with **Elisabeth** and the *Passions of the Soul* (cf. Sorell 2005, 160–61).

See also *Cogito Ergo Sum*, *Dioptrics*, *Knowledge*, *Objections and Replies*, *Optics*, *Philosophy*, *Scholasticism*

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TOM SORELL

HOGELANDE, CORNELIS VAN (CA.1590–1662)

Van Hogelande was the son of a Catholic nobleman from Zeeland. Both his father (Johannes) and his uncle (Theobald) were interested in scientific questions, Theobald being known as an alchemist. Little is known about Cornelis's life, except that he remained unmarried and that he settled at Leiden as a medical practitioner, after studies at Leiden and presumably also abroad. He was a trusted friend of Descartes, who on leaving for Sweden put him in charge of a trunk with personal belongings. In a letter to Van Hogelande, Descartes gives his definitive and fairly negative judgment on Comenius (1592–1670). Van Hogelande also published two philosophical works: *Cogitationes quibus Dei existentia, item animae spiritualitas ... demonstrantur* (1646) and *De divina praedestinatione* (1653). In the *Conversation with Burman*, Descartes suggests that, despite the fact that Van Hogelande never follows him exactly, he understands the spirit of his work, which is true. Van Hogelande argues for the **existence** of a providential agent behind the continually changing world of

nature, who controls the mechanism of the human **body** and the **machine** of the universe, the difference between bodies and humans being that the latter have consciousness. **Free will** on the other hand would consist in freely consenting to what cannot be denied.

See also Conversation with Burman, Free Will, Human Being, Machine

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THEO VERBEEK

HOLENMERISM (HOLENMERIANISM)

Descartes sometimes writes that the **mind** is in the **body** as whole in the whole and whole in the parts. In this sense, he claimed, the mind is extended but in a sense different from body. **Henry More** labeled this view "holenmerism." The view had been around since at least Plotinus, and it was used in two contexts that both address the presence of spiritual **substances** in the physical world. First it was used to describe the way spiritual substances, **angels**, human souls, and especially **God** act on bodies. God can act anywhere in the physical world, but his doing so, the argument goes, requires his presence where he acts. God cannot, however, be present in the physical world in the way in which a body is present, that is whole in the whole and part in the part, with parts being distributed, because God has no parts. So the only way God could be present in a multiplicity of physical locations is by being present in his entirety in every one of them (Suárez, *Disputationes metaphysicae* XXX. VII, Grant 1981).

The second use of holenmerism concerns the presence of the human soul in its body where the issue is not interaction, and this use can be found in **Augustine** and Plotinus, and in Aristotelian **Scholasticism**. The human soul is a spiritual substance and does not have parts that can be spread out through the body. Within Scholasticism, the human soul was also a **substantial form**, but its status as a spiritual substance made it a special one. Thus, **Suárez** claims that in a plant its soul is present whole in the whole, part in the part. This explains why we can cut off a branch and use it to start a new plant. A part of the soul remains in the branch, and thus it continues to live. But this is not the case for a **human being**. The case of higher **animals** was considered to be difficult (Des Chene 2000, ch. 9).

Descartes too uses holonmerism in two contexts. First, he suggests that it helps understand mind-body interaction or, to be precise, the action of mind on body (see **human being**). Descartes treated the directions of interaction differently, and he did not apply holonmerism to the action of body on mind. His holonmerism must be distinguished from his speaking of mind and body as being intimately united and “as it were intermingled,” expressions he uses only in the context of the action of body on mind. He does not rely on holonmerism to argue for the closeness of the union of mind and body or for the mind-body composite being a genuine unity (Rozemond 1998, ch. 6).

His fullest **explanation** of holonmerism occurs in a discussion of the ordinary notion of heaviness (see **gravity**). He thinks this notion includes the **idea** of heaviness as being extended “whole in the whole and whole in the parts of the body,” which must be distinguished from the **extension** of bodies,

which excludes any penetrability of parts; but I thought that there is the same amount of heaviness in a mass of gold or some other metal of one foot as in a piece of wood of ten feet; and so I thought that it can all be contracted to one mathematical point. I also saw that while heaviness remains extended throughout the heavy body, it could exercise its whole **force** in any part of it; for if the body were hung from a rope attached to any of its parts, it would pull the rope down with all its heaviness, just as if this heaviness was only in the part touching the rope instead of also being spread through the other parts. This is exactly the way in which I now understand the mind to be coextensive with the body. (AT VII 441–42, CSM II 297–98)

This suggests that the soul can act directly on any part of the body, a view in tension with his well-known claim that interaction occurs at the **pineal gland**. But Descartes’ point probably was that although the soul is united to the whole body, it can act in its entirety in one location.

Descartes also implicitly refers to holonmerism in contexts where interaction is not at stake. Sometimes he writes that the whole soul is joined to the whole body, but when a limb is cut off, no part of the soul is lost, a point others made in the context of holonmerism (AT VII 86, CSM II 59; Suárez, *De anima* I. XIV.9, 10). The whole body is involved in the sense that a soul must be united to a whole human body (*Passions* I.30). In this type of context, he contrasts holonmerian union with interaction at the gland.

Holonmerism is a very puzzling idea, and it does not clearly fit into Descartes’ **dualism** (Wilson 1978). Given his mechanistic conception of body, it is hard to see how there is any substantive sense in which the mind or soul is present *in* the whole body. Furthermore, holonmerism does not really help explain mind-body interaction; at most it addresses questions about the *location* of interaction but not *how* a mind can produce effects in a body.

See also Extension; Form, Substantial; Gravity; Human Being; Quality, Real; Scholasticism

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MARLEEN ROZEMOND

HUET, PIERRE-DANIEL (1630–1721)

Born in Rouen and educated in the **Jesuit** college of Caen, Huet was a noted literary scholar and linguist. He alternated between Paris and Caen for most of his life, but spent a year in the court of **Queen Christina of Sweden** in 1652 (two years after Descartes' death there). He returned to Caen to work on an edition of Origen's commentaries, having found some rare texts of his in Sweden. In 1662 he helped found an academy of science in Caen. Huet was appointed tutor (*sous-précepteur*) to the dauphin (under *précepteur* Jacques Bossuet) in 1670 and elected to the French Academy in 1674. He was named Abbé d'Aunay in 1680, shortly after his ordination, and then nominated bishop of Soissons in 1685. However, as a result of troubles between Paris and Rome, his consecration at Soissons never took place. Instead, he was named bishop of Avranches in 1689, a position he assumed in 1692. He resigned his bishopric and took on the title of Abbé de Fontenay in 1699, retiring soon thereafter to the Paris house of the Jesuits that held the huge personal library he had bequeathed to them (and which ultimately was incorporated into the collection of the Bibliothèque Nationale). Huet died there in 1721 after a remarkably long life.

Huet reported in his *Mémoires* (1718) that he was initially a supporter of Cartesian **philosophy** but that he turned against it once he realized that "it was a baseless structure that tottered from the very ground." He became disenchanted with Descartes' philosophy because of its disdain for humanist values, the study of history,

geography, and dead languages. This change of opinion resulted in Huet's critique of Descartes, the *Censura philosophiae cartesianae* (1689), whose chapters discuss a wide range of Cartesian topics, including **doubt**, the *cogito*, the criterion of **truth**, the human **mind**, arguments for the **existence** of **God**, **body** and void, the origin of the world, and the **cause** of **gravity**. Huet's skeptical arguments in the *Censura* are consistent with the position he develops in later works that **reason** requires the guidance of faith and the Catholic tradition. The *Censura* drew a response from various readers, including **Pierre-Sylvain Régis** – the “Prince of the Cartesians,” as Huet called him. Huet also published anonymously *Nouveaux mémoires pour servir à l'histoire du cartésianisme* (1692), a satirical account of an interview with a Descartes who was teaching in Lapland, having escaped death in Sweden. Despite his intensive pastoral duties, Huet was in Thomas Lennon's (Huet 2003) words an “erudite” who was engaged in many other pursuits, both literary and scientific.

See also Cogito Ergo Sum; Doubt; Régis, Pierre-Sylvain

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ROGER ARIEW

HUMAN BEING

Despite his famous claim that **mind** and **body** are really distinct **substances**, Descartes repeatedly points out that a human being is not a mere composite of two entities. For example, he calls the human being “a true *ens per se*” and asserts that the mind “is united in a real and substantial manner to the body” (AT III 493, CSMK

206). If we intend to give a full account of a human being, we need notions not just of mind and of body but also of the union of mind and body – the latter notion being as primitive as the other two and therefore irreducible to them (AT III 665, 691; CSMK 218, 226). Only this third notion enables us to describe and explain the features that are distinctive of a living human being – namely, sensory **perceptions** and **passions** (see **primitive notion**).

Given this thesis, it is hardly surprising that Descartes does not conceive of himself as a purely immaterial mind once he has completed an analysis of mind and body. Nor does he claim that his body is only accidentally connected to his mind, serving as a mere instrument. In the Sixth Meditation, he unmistakably holds that his mind is not in his body as a sailor is present in a ship. It is rather “very closely joined” to the body and, as it were, “intermingled with it” (AT VII 81, CSM II 56). Should there be no intermingling, no **sensations** of hunger, thirst, and pain could arise, because it is neither the mind alone nor the body alone that has these states, but the union of mind and body.

But what is the metaphysical status of this special union? It seems at first sight as if Descartes were committing himself not just to the often-mentioned **dualism** but to some form of “trialism” (Cottingham 1985, Schmaltz 1992). His claim that there are three irreducible basic notions seems to amount to the thesis that three types of substances, referred to by these notions, should be distinguished: bodily substances (e.g., plants and **animals**), mental substances (**God** and **angels**), and bodily-mental substances (human beings). When talking about a “substantial union” (AT III 508, CSMK 209; cf. AT VII 228, CSM II 160), he seems to suggest that a human being is in fact a special substance and not simply a composite of other entities. In some letters he hints at this trialist position, suggesting that there could be a single substance that is both thinking and extended (AT III 508, 693–94; CSMK 209, 227–28). However, in the *Principles of Philosophy*, where he presents his metaphysical program, he unequivocally holds that there are “only two ultimate classes of things,” namely bodily and mental substances, and that each substance has only one principal **attribute** that constitutes its nature (AT VIIIA 23, CSM II 208). Moreover, he defends the epistemological principle that a substance can be known through its specific attribute (AT VIIIA 25, CSM I 210). Thus, we can gain **knowledge** of a bodily substance by realizing that it is an extended thing with a certain length, breadth, and depth. Likewise, we can gain knowledge of a mental substance by noticing that it is a thinking thing with a number of perceptions. Yet, in the case of a mind-body union there clearly are *two* principal attributes. For instance, when dealing with a human being who is in pain, we need to notice that he or she is an extended thing with a number of bodily states (among them an injury of some bodily part) and a thinking thing with a feeling of pain. It is precisely the co-presence of two principal attributes and, consequently, the coexistence of two kinds of states that is distinctive of a mind-body union. This union cannot be a substance *sui generis* because it lacks a

single principal attribute. It can only be an entity that is composed of two intimately related substances, as even the interpreters who talk about “trialism” concede (Cottingham 1985, 229; for further arguments against trialism, see Kaufman 2008).

How, then, is the intimate relation to be understood? Some commentators have argued that Descartes’ talk about an *ens per se* or a “substantial union” should not be understood as an expression of his own opinion since he used these technical terms in his **correspondence** with Scholastic authors or, as in the case of **Henricus Regius**, with authors who were facing attacks launched by traditional Scholastics (Chappell 1994, 411–12) (see **Scholasticism**). His Scholastic parlance would then be no more than a rhetorical strategy of defending himself and his pupils against these attacks. Other commentators, however, have taken the Scholastic expressions seriously and have interpreted it as a commitment to hylomorphism (Hoffman 1986 and 2008). A mind-body union would then not be a strange amalgamation of two incompatible substances, but a unified entity that consists of two components – namely, mind (form) and body (matter). At first sight, a number of passages speak in favor of this interpretation. In a letter to Regius, Descartes writes that the human soul can be “recognized as merely a **substantial form**” (AT III 503 and 505, CSMK 207–8), and both in the early *Rules for the Direction of the Mind* and in the later *Principles*, he holds that the soul (or mind) is precisely that which is “informing the entire body” (AT X 411, CSM I 40; AT VIIIA 315, CSM I 279; cf. AT IV 167, CSMK 243). In the Fifth Replies, he even remarks that the word “soul” can be understood “as meaning the ‘first actuality’ or ‘principal form of man’” (AT VII 356, CSM II 246), and in a letter to **Mesland** he acknowledges that the body remains numerically the same body “so long as it remains joined and substantially united with the same soul” (AT IV 166, CSMK 243). He obviously uses traditional Aristotelian vocabulary and thereby seems to support the position defended by Scholastic Aristotelians, most notably by **Thomas Aquinas** and **Francisco Suárez** (Des Chene 2000): since the human soul is a substantial form, it makes a human being a complete, unified entity and guarantees its identity over **time**. It is also the soul that makes it possible for this entity to have a number of typically human states.

But is Descartes really committed to hylomorphism? One could object that this option is not open to him because he constantly criticizes Aristotelian **metaphysics**. He mockingly remarks that forms are obscure entities and “nothing but chimeras” (AT III 212; Hattab 2009, 16–30). He repeatedly points out that he rejects dubious entities such as forms and **real qualities** in order to explain the physical world and invokes only material corpuscles and mechanical processes among these corpuscles (AT II 200; Garber 1992, 94–116). So, if he condemns the Aristotelian-Scholastic appeal to forms as explanatorily vacuous, he cannot refer to forms in order to explain the union of mind and body.

This reply, clear and compelling as it seems, is not fully adequate. Although Descartes rejects hylomorphism in order to explain purely material things and their

behavior, the possibility remains that he takes hylomorphism to be satisfactory with respect to other entities, such as human beings, which are not purely material things. In the Sixth Replies, he hints at this distinction. He first points out that it is erroneous to appeal to forms or qualities in order to explain the **gravity** of a heavy body; merely claiming that some hidden form is in the whole body and draws it to the ground does not explain anything. But he then hastens to add that the relation between mind and body is a different case: "This is exactly the way in which I now understand the mind to be coextensive with the body – the whole mind in the whole body and the whole mind in any one of its parts" (AT VII 442, CSM II 298). Here he clearly refers to Aristotelian **holenmerism**, that is, to the thesis that the substantial form is not present in one part of the body only but exists indivisibly in the whole body (Rozemond 2003). So it seems as if one could distinguish two explanatory strategies: with respect to mere bodies Descartes uses a materialist-mechanistic strategy but with respect to mind-body unions he opts for hylomorphism.

Yet there are at least three reasons that speak against this line of interpretation (for further reasons, see Rozemond 1998, 139–71). First, his notion of matter radically separates him from Scholastic predecessors (see **body** and **extension**). For traditional Aristotelians, matter is something potentially existing that needs to be actualized. That is why the soul as form is not only responsible for the fact that a piece of matter is a unified thing, capable of having a number of states, but also that which accounts for the fact that there is an actual piece of matter and therefore also a natural body. It is the form, as Aquinas famously pointed out, that "actualizes a body" (*Summa Theologica* I, q. 75, a. 1). On Descartes' view, a body, whether human or non-human, is in itself something with actual **existence**, consisting of many corpuscles. It has a certain extension and does not need to be made a particular thing, be it by a form or by some other entity. Therefore, it would be superfluous to posit forms in the Aristotelian sense: where nothing needs to be actualized, no principle of actualization is required. If Descartes nevertheless speaks about souls as forms, he uses this old expression in a very specific sense. Souls are not confined to some parts of the body. Nor can they be subdivided into different parts that could be assigned to different bodily organs. As immaterial substances, they are indivisible and entirely present in the whole body. They permeate, as it were, or "inform" the whole body. This is, of course, a point that had already been stressed by Scholastic Aristotelians. But they took it to be a consequence of the actualization thesis (if the soul actualizes the potentially existing body, it must do so in the whole body), whereas Descartes rejects this thesis and thereby refutes the core of hylomorphism.

Second, Aristotelians took the soul to be not only the principle of actualization but also the principle of life in a body. It is precisely the soul that is responsible for vital functions such as breathing, nourishing, and procreating. That is why they categorically denied that a dead body is a body at all. Should a corpse still be called a body, the word "body" would be used homonymously, as Aquinas emphasized

(*Summa Theologica* I, q.76, a.8). Descartes does not endorse this view. He decidedly rejects the idea that the soul is the principle of life: “So as to avoid this error, let us note that death never occurs through the absence of the soul, but only because one of the principal parts of the body decays” (AT XI 330, CSM I 329). Should someone ask what accounts for the difference between a living and a dead body, the answer would be: the mere fact that an important organ, say the heart or the lung, decayed and that the body ceased to function properly. The decay is to be explained in a mechanistic way, as Descartes makes clear with his comparison of a human body and a clock (Des Chene 2001). Just as the clock stops working when one or many of its parts are no longer active, a human body dies when one or many of its organs are inactive. And the inactivity is nothing but the result of the dissolution or failing interaction of the parts. That is why one can very well call a dead body a body, as long as one specifies that it is a dysfunctional body. No lack of a principle of life needs to be mentioned. Consequently, no form in the Aristotelian sense is required. Commentators who defend the hylomorphist interpretation concede this point but emphasize that Descartes nevertheless appeals to a principle of organization that is present in the working clock or in the living body (Hoffman 2007). However, separating the principles of life and organization amounts to taking a significant step away from hylomorphism.

Third, traditional Aristotelians would claim that the soul is responsible not only for basic vital functions but also for cognitive activities such as perceiving, imagining, and thinking. In order to distinguish different types of activities and their causal principles, they referred to various faculties or “parts of the soul.” Most Aristotelians talked about vegetative, sensory, and intellectual parts; some introduced even more parts – for instance, the sensory-apprehensive and the sensory-appetitive parts (Des Chene 2000, 155–89; King 2008). Descartes rejects all talk about parts of the soul (AT XI 364, 379; CSM I 346, 352). Should one accept parts, one would inevitably describe the soul as a complex thing that can be subdivided. And if it could be split up into parts, it could be dissolved like any other thing that has parts. Only a simple thing that has no parts is indissoluble. That is one reason why Descartes holds that the soul is a “pure substance” (AT VII 14, CSM II 10) and therefore an entity that never perishes (for other reasons, see Rozemond 2010). This simple thing has one single type of activity, namely thinking. Even seemingly different activities like perceiving and imagining, which Aristotelians assigned to the sensory part of the soul, are nothing but acts of thinking. So it does not make sense to claim that the soul is an all-embracing form but that it nevertheless has different parts responsible for different activities. If Descartes still speaks about the soul as form or even principle, he does so in order to stress the point that the soul is an active substance that gives rise to many acts of thinking. He makes this clear in the Fifth Replies when he first claims, seemingly following the Aristotelian tradition, that the soul is “the principal form of man,” but then explains that “the term must be understood to apply only to

the principle in virtue of which we think" (AT VII 356, CSM II 246). Readers should therefore not be misled by the use of Aristotelian terminology. The term "form" refers not to a complex principle that accounts for a wide range of activities but to a simple principle that has one single function. This principle, not bound to the perishable body, is an immaterial substance.

How, then, is Descartes' description of the union of mind and body as a "substantial union" and an *ens per se* to be understood if he defends neither a trialist nor a hylomorphist position? One could have the impression that his talk about a special union is nothing but a rhetorical device that he uses in order to disguise the simple fact that his substance dualism does not create space for a genuine unity of mind and body. And, in fact, one commentator explicitly claimed that in Descartes we reach "the end of anthropology" (Voss 1994). If a human being is nothing more than a composite of two distinct substances that have different attributes, no irreducible unity seems to be possible.

Yet this pessimistic conclusion is not compelling (Rodis-Lewis 1990). It relies on the assumption that Descartes needs to introduce a special metaphysical category in order to provide a satisfactory explanation of the unity. But he chooses another strategy, namely the appeal to a functional account. This becomes clear in the Sixth Meditation where he first states that mind and body are "closely joined" and then presents the following argument: "If this were not so, I, who am nothing but a thinking thing, would not feel pain when the body was hurt, but would perceive the damage purely by the **intellect**, just as a sailor perceives by sight if anything in his ship is broken. Similarly, when the body needed food or drink, I should have an explicit understanding of the fact, instead of having confused sensations of hunger and thirst" (AT VII 81, CSM II 56). Obviously, there are pragmatic reasons for the close connection between mind and body. We would not survive if damage to our bodily parts did not immediately give rise to feelings of pain, which motivate us to take care of our body and to protect it. Likewise, we would not survive if dehydration did not give rise to sensations of thirst, which motivate us to look for something to drink. Descartes even uses teleological vocabulary when he explains the need for the close connection between bodily and mental states: "For the proper purpose of the sensory perceptions given me by nature is simply to inform the mind of what is beneficial or harmful for the composite of which the mind is a part; and to this extent they are sufficiently clear and distinct" (AT VII 83, CSM II 57). With this use of the expression "proper purpose" (*datae sunt ad significandum* in Latin, literally meaning "they are given in order to signify"), Descartes does not commit himself to positing inner final **causes** that somehow mysteriously fix a goal for sensory perceptions. There is no special cause in the mind or in the body that would set a goal for, say, feelings of thirst. When Descartes says that these feelings are present in order to inform the mind, he simply means that they have a natural function given by a general order in nature. The teleological language is therefore to be understood in a functional

sense. One could even say that Descartes intends to give “a bio-functional account” of sensory perceptions (Simmons 1999, 355). For what is important about such feelings as thirst, hunger, and pain is not so much what they tell us about things in the world but what they indicate about our own body. They conduce to self-preservation by directing our attention to what is harmful to our body, thereby motivating us to take measures against dangerous influences (see **sensation**).

Given this biofunctional account, it is understandable why Descartes invokes three basic notions but only two types of substances. The third notion, namely the notion for the mind-body union, does not pick out a special substance that exists over and above the other two substances. Nor does it refer to a peculiar amalgamation of these substances. It is simply meant to refer to a functional unity between mind and body – a unity that makes states such as thirst and pain possible. These states have two components that are interrelated: the mental component is meant to draw one’s attention to the bodily one. In light of this interrelation, Descartes carefully distinguishes between purely mental states – for instance, acts of mathematical thinking, which could even appear in a detached mind – and states that are “not pure **thoughts**” (AT III 493, CSMK 206), among them feelings of thirst or pain, which can be present only in a mind-body union.

Descartes illustrates the functional unity with a telling example (AT III 493, CSMK 206; cf. AT V 402, CSMK 380). If an angel were somehow miraculously placed in a human body, he would not have sensory perceptions as we do. He would not feel pain when a bodily part, say a foot, is injured, but would simply observe the effect in the foot caused by an external object. To draw a modern **analogy**, one could say that the angel would behave like a person who happens to witness a car accident. He sees that another person has been injured, he notices the damage done to the foot and hears the cries, but he does not feel anything at all. He is a mere observer who is detached from the damaged body. Why? Because his mental states do not have the function of alarm signals. They are not meant to inform the angel that the body is in danger and that it needs protection. They are rather “pure” mental states, that is, states that are completely separated from processes in the body and that indicate in a neutral way what is happening to the body. Human beings, by contrast, have “impure” mental states that are not only caused by bodily ones but that are also meant to indicate them as one’s own states. They are, as it were, subjective alarm signals.

Not only sensory perceptions but also passions have this function. Descartes devotes large parts of the *Passions of the Soul* to an analysis of how bodily states cause certain perceptions, how these perceptions make us attentive of our body, and how they motivate us to undertake certain actions. Right at the beginning he emphasizes that a **passion** always has a bodily and a mental component and that these components should be considered as interrelated, for “what is a passion in the soul is usually an action in the body” (AT XI 328, CSM I 328). In making this claim,

he seems to invoke “straddling **modes**” that are both in the body and in the mind (Hoffman 1990, 313). Yet this would hardly be compatible with his general thesis that each mode belongs to one substance only (AT VIIIa 29, CSM I 213–14). It is more reasonable to understand him as saying that a passion always has two components and that we should therefore pay attention to both bodily *and* mental states if we want to give a full account (Brown 2006, 116–40). What is remarkable about the passions is that the relation between these two types of states is not fixed once and forever by a natural order. We can modify this relation by means of acts of willing, **judgments**, and processes of habituation (see **habit**). It should in fact be our goal, as Descartes points out, to become “masters of our passions and to control them” (AT XI 488, CSM I 404). Only if we try to react in new and different ways to bodily states caused by external objects can we overcome mental states of fear and sadness.

Descartes’ remarks about the possible control of passions show that he conceives of the mind-body union as a “dynamic relation” (Shapiro 2003, 213). Despite the fact that a human being is composed of two substances and that a causal relation between them is naturally given, there is no necessary natural order. The mental substance has such a power that it can rearrange the causal relation to some degree. That is why a human being is not a mere **automaton** that inevitably displays a certain mental output when it receives a certain bodily input. It can actively shape the mind-body relation and thereby not only notice that the two substances are closely connected but also determine how they are connected.

Yet Descartes’ claim that there is a causal relation between mind and body gives rise to a serious problem. How can there be such a relation if mind and body are not only really distinct but also heterogeneous substances? How should an extended substance be able to act upon a thinking one or vice versa? In some passages, Descartes suggests that the **pineal gland** is “the principal seat of the soul” and that it is in this part of the brain that an interaction takes place (AT III 19, 123; CSMK 143, 149). But this appeal to some kind of meeting point for mind and body does not resolve the problem. On the contrary, it makes it even more explicit because the pineal gland is clearly part of the body. How can the nonextended mind act upon the extended pineal gland or vice versa? Simply assuming that an interaction takes place where no exchange between two heterogeneous substances is possible is a real “scandal,” as some commentators think (Williams 1978, 287; Watson 1987) – precisely the scandal that provoked Descartes’ immediate successors to work out different accounts of the mind-body relation, among them occasionalism and preestablished harmony (see **cause**).

Unlike his readers, Descartes himself does not see any special problem in the causal relation between mind and body. When Arnauld asks him for further **explanation**, he simply answers that “it is one of those self-evident things which we only make obscure when we try to explain them in terms of other things” (AT V 222, CSMK 358). And to Burman, who also insists on a detailed account, he replies that

“our experience is sufficient, since it is so clear on this point that it just cannot be gainsaid” (AT V 163, CSMK 346). It looks as if Descartes were accepting the causal relation as a brute fact. It is therefore hardly surprising that some interpreters believe that no explanation should be sought where none was intended (Radner 1985).

A closer look at Descartes’ texts shows, however, that he has a particular kind of relation in mind, especially when he talks about the body acting upon the mind. He does not claim that the body transmits something to the mind but cautiously remarks that states of the brain “will give an occasion to the soul” to bring about **ideas** (AT XI 149), that they give “a sign to the mind” (AT VII 88, CSM II 60), or that mental states “immediately follow” movements in the brain (AT VIIIA 316, CSM I 280). This language makes clear that he appeals to some form of occasional causation (Nadler 1994; Perler 1996, 142–45); “bodily state *x* causes mental state *y*” simply means “*x* is an occasion for the occurrence of *y*.” To be sure, this does not amount to occasionalism, because Descartes does not hold that God is the only real cause and that all natural states are only an occasion for God to become active. He insists on the fact that bodily states are real causes, but not causes that literally affect the mind. In modern terminology, they are only triggering causes but, nevertheless, causes that have their own power.

In the *Comments on a Certain Broadsheet*, Descartes even goes so far as to claim that all ideas, that is, all mental states with a representational content (including those of pain, colors, and sounds), are innate and that “our mind can display them to itself on the occasion of certain corporeal motions” (AT VIIIB 359, CSM I 304). He clearly denies that anything is sent from the body to the mind or that the body generates something new in the mind. The mind is already equipped with all possible ideas. It simply needs to activate them, and bodily states as triggering causes make this possible. For instance, when someone has an injured foot that causes a certain brain state, this state gives an occasion to the mind to bring about an actual feeling of pain. This feeling is merely activated, not somehow implanted in or transferred to the mind.

Given this model of occasional causation, no mysterious interaction between mind and body is required. It is sufficient that the two substances are well coordinated so that certain bodily states make the actual presence of certain mental states possible. But why is there coordination at all? Why is Descartes so confident that, say, the brain state caused by the injured foot gives rise to pain and not to pleasure? It is at this point that the biofunctional account of the mind-body union plays an important role: there is a natural order that links certain bodily states to certain mental ones (AT VII 83–84, CSM II 57–58). We would simply not survive if the brain state caused by an injury would give rise to a feeling of pleasure. That is why it is important to conceive of mind and body not as two randomly combined substances but as a functional unity in which certain bodily states are, as it were, designed to give rise to certain mental states. We may perhaps never be able to understand how two really

distinct substances are united, as Descartes concedes in his correspondence with **Princess Elisabeth** (AT III 692, CSMK 227), and we should not torment ourselves with metaphysical speculation, as he hastens to add. Nor should we try to establish a science of psychology that is as certain as **physics** (Alanen 2008). Since this science deals with the mind-body union that cannot be clearly and distinctly conceived, it will never provide firm and solid **knowledge**. But even if we lack knowledge of *how* there can be a union, we experience *that* there is one, and we are able to give a detailed description of all the states this union enables us to have.

See also Angel; Attribute; Body; Cause; Distinction (Real, Modal, and Rational); Dualism; Form, Substantial; Holenmerism; Mind; Primitive Notion; Scholasticism; Sensation; Soul, Immortality of the; Substance

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DOMINIK PERLER

HUYGENS, CHRISTIAAN (1629–1695)

Apparently destined for a similar career as his father and brothers, **Constantijn Huygens**'s second son, Christiaan, was sent to Leiden to study law. Actually, he spent most of his time studying **mathematics** with Frans Van Schooten (1615–60), the Latin translator of Descartes' *Geometry* and one of the few who could understand it, in preparation of his first work, on the quadrature of the hyperbole and the ellipse (1651). With a powerful self-built telescope, he discovered in 1655 the first moon of Saturn (Titan) and made numerous other observations, which firmly established his reputation as an astronomer. Of great practical importance was his invention of the pendulum clock (patented in 1657). He was invited to become one of the founding members of the Académie des Sciences (1666) and until 1681 settled in Paris, returning several times to The Hague, though, for reasons of health. In Paris he became increasingly critical of Descartes' **physics**, more particularly of his laws of collision (see **law of nature**). In 1689 he made a last journey to

London, where he met **Sir Isaac Newton**. Although he admired Newton's mathematical genius, he remained skeptical of his "improbable principle of attraction" as well as his corpuscular theory of **light**. He died in 1695, his last years being devoted, among other things, to the problem of extraterrestrial life (published posthumously as *Cosmotheoros*, 1698). In his *Traité de la lumière* (1690), he provided a synthesis of his theory of light. Huygens was undoubtedly one of the greatest among the physicists, astronomers, and mathematicians of his age, bringing to Cartesian physics a mathematical as well as a practical and empirical mind, which allowed him to show the limits of the Cartesian **method**, unwillingly perhaps for in his heart he preferred a purely mechanical model.

See also Huygens, Constantijn; Laws of Nature; Light; Newton, Isaac; Physics

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THEO VERBEEK

HUYGENS, CONSTANTIJN (1596–1687)

The second son of a high government official, Constantijn Huygens received an all-round education before studying law at Leiden. As a diplomat he made several

journeys abroad before being appointed (1625) private secretary of the stadholder, Frederick-Henry of Orange (1584–1647). He continued in this position under his son, William II (1626–50) and remained attached to the Orange family as an adviser on political, financial, and artistic questions. Huygens was a highly cultured and extremely versatile diplomat, poet, playwright, musician, and composer who spoke many languages, wrote hundreds of poems (in Dutch, Latin, and French), and took a keen interest in applied science. Huygens became interested in Descartes' work after attending a demonstration by Descartes of his *Dioptrics* at Golius's home in 1632. After a personal meeting in Amsterdam in 1635, contacts intensified, and the two started a correspondence. Huygens encouraged Descartes to publish a few specimens of his early work and not deprive the world of his insights. Although Huygens had his hopes set on *The World*, which Descartes withheld to avoid alienating the church, these efforts eventually resulted in the publication of the *Discourse on Method* and accompanying essays (1637). He also supported Descartes in his efforts to realize the **machine** for grinding hyperbolic lenses described in the *Dioptrics* (AT VI 211–27) and commissioned a work on **mechanics** (*Explication des engins*, 1638). When he was not with the army, he dispatched Descartes' mail safely and quickly via the Dutch embassy in Paris; he used his influence during Descartes' conflicts with the Utrecht and Leiden universities; and on his behalf he mobilized his wide network. Although Descartes gratefully accepted all that, he politely but resolutely resisted Huygens's covert suggestions to become his official patron. That role would befall **Princess Elisabeth** and **Queen Christina**, two women clearly of a much higher social rank. In the eyes of Descartes, a nobleman, Huygens remained, much to the latter's frustration, a commoner after all.

See also Christina, Queen of Sweden; *Discourse on Method*; *Dioptrics*; Elisabeth, Princess of Bohemia; Huygens, Christiaan

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THEO VERBEEK

HYDROSTATICS

Hydrostatics was one of the areas of “mixed **mathematics**” – including geometrical **optics**, positional astronomy, harmonics, and **mechanics** – developed by Alexandrian authors in the Hellenistic era. Until the late sixteenth century the canonical work on hydrostatics was “On Floating Bodies” by Archimedes (ca. 287–212 B.C.E.). It deals in a rigorous geometrical manner with the conditions under which fluids are at rest in statical equilibrium and with the equilibrium conditions of solid **bodies** floating in or upon fluids.

At the end of 1618, the twenty-two-year-old Descartes, working with **Isaac Beeckman**, addressed some problems in hydrostatics involving the “hydrostatic paradox.” In 1586 Simon Stevin, the leading exponent of the mixed mathematical sciences at the time, brilliantly extended Archimedean hydrostatics. He demonstrated that a fluid filling two vessels of equal base area and height exerts the same total pressure on the base, irrespective of the **shape** of the vessel and hence, paradoxically, independently of the amount of fluid it contains. Stevin’s mathematically rigorous proof applied a condition of static equilibrium to various volumes and weights of portions of the water (Stevin 1955–66, 1:415–17).

In Descartes’ treatment of the hydrostatic paradox (AT X 67–74), the key problem involves vessels B and D, which have equal areas at their bases and equal height and are of equal weight when empty (see Figure 12). Descartes proposes to show that “the water in vessel B will weigh equally upon its base as the water in D upon its base” – Stevin’s hydrostatic paradox (AT X 68–69).

First Descartes explicates the weight of the water on the bottom of a vessel as the total force of the water on the bottom, arising from the sum of the pressures exerted by the water on each unit area of the bottom. This “weighing down” is explained as “the **force of motion** by which a body is impelled in the first instant of its motion,” which, he insists, is not the same as the force of motion that “bears the body downward” during the actual course of its fall (AT X 68).

In contrast to Stevin’s rigorous proof, Descartes attempts to reduce the phenomenon to corpuscular mechanics by showing that the force on each “point” of

can explain the pressure a fluid exerts on the floor of its containing vessel. These moves imply a radically non-Aristotelian vision of how the mixed mathematical sciences, such as hydrostatics, should relate to natural philosophizing (Gaukroger and Schuster 2002, 549–50).

Although Descartes never again directly considered hydrostatical problems, this early fragment is of tremendous importance for understanding his mature natural philosophy. Throughout his later career Descartes continued to use descendants of the concept of instantaneous tendency to motion analyzable into its directional components (later termed “determinations”) (see **force and determination**). These ideas are central to his “dynamics,” the concepts that govern the behavior of micro-corpuscles in *The World* and the *Principles of Philosophy* (see **light** and **vortex**).

See also Beeckman, Isaac; Force and Determination; Light; Mechanics; Physico-Mathematics; *Principles of Philosophy*; Vortex; *The World*

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JOHN A. SCHUSTER

HYPERASPISTES

“Hyperaspistes” is the name of an anonymous critic of the *Meditations*. The word derives from the Greek word for “champion” or “defender” (CSMK 188 n. 1). In the collection of letters assembled by **Clerselier** (vol. 2), it is Letter XV that is from a man calling himself “Hyperaspistes.” A version of this letter is found in volume 3 of the Adam and Tannery collection (AT III 397–412). However, unlike Letter XV

of the Clerselier collection, the Adam and Tannery letter does not explicitly identify Hyperaspistes as the author (although it is speculated in a footnote). Versions of Descartes' reply are also included in both the Clerselier and the Adam and Tannery collections (AT III 422–35, CSMK 188–97). There appears to have been a precedent for the use of the pseudonym “Hyperaspistes.” It is found, for example, in the title of a book written by **Johannes Kepler** (1625), in which Kepler dubs himself “Hyperaspistes” or “defender” of Tycho Brahe.

Some have speculated that Hyperaspistes was a physician or perhaps a priest interested in **philosophy**, for in his objections to Descartes he mentions his encounter with a blind man among “our three hundred blind men living at Paris” (AT III 409). Some, including **Baillet**, believed this to be a reference to the Hôpital des Quinze-Vingts, a Paris almshouse for the blind. This and other clues led Baillet to speculate that Hyperaspistes was very likely a man by the name of M. Porlier (Agostini 2003, 8). Igor Agostini (2003, 7) argues against Baillet's conclusion. Other scholars have speculated that Hyperaspistes was a member of a group of natural philosophers associated with **Pierre Gassendi**, author of the Fifth Objections. In the Adam and Tannery collection, Hyperaspistes' objections are made in a letter dated July 1641 (AT III 397–412). The letter is written in Latin and includes fourteen objections. Descartes expresses to Hyperaspistes the possibility of including the exchange in the first printing of the *Meditations* (AT III 422, CSMK 188). But their exchange did not make it into the final printing.

The objections are interesting and worth examining. The most salient objection presses Descartes on the claim that the **true and immutable nature** of a triangle depends directly on **God**. Hyperaspistes writes: “Let God do whatever he can, and suppose (*per impossibile*) that he never thinks of a triangle ... wouldn't you admit that the following would still be true, namely that the three angles of a triangle are equal to two right angles?” (AT III 406). In response, Descartes refers Hyperaspistes in part to his replies to the Sixth Objections, article 8. There, he had argued that the “limits” of intelligibility, which determine what can and cannot be conceived and which are coextensive with what can and cannot be, are determined by God (AT VII 436, CSM II 294). A triangle is intelligible only because God thinks it. To say that God can think of a triangle only because it is intelligible (so that the nature of the triangle determines what God can think) would be to say that God's **mind** is determined by something other than himself. This view would be theologically problematic. According to Descartes, this is precisely where Hyperaspistes' view leads.

Descartes suggests to Hyperaspistes that his hypothetical case construes the ontological dependence relation in the wrong direction, for “it is much more certain that nothing can exist without the concurrence of God than that there can be no sunlight without the sun” (AT III 429, CSMK 193). Descartes explains why someone might have trouble understanding this by noting that not everyone is aware of his or her innate **idea** of God. “Some people will perhaps not notice it even after reading

my *Meditations* a thousand times” (AT III 430, CSMK 194). But once the innate idea of God is properly understood, and its place in Descartes’ epistemology understood, one will know that all creatures, including the nature of the triangle, depend on God for their being, and not the other way around.

See also Clerselier, Claude; Gassendi, Pierre; Idea; *Meditations on First Philosophy*; True and Immutable Nature

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IDEA

Ideas are **modes** of **thought** that function in various important ways in Descartes' **philosophy**. It is in virtue of ideas that thought is intentional and gives meaning to words. Ideas are the subject matter for true and false **judgments** that are expressed in propositional forms, and they are the basis of the certain foundations of **knowledge** (*scientia*). This variety of functions is correlated with a complex set of theoretical distinctions that apply to ideas. Most of these are first explained rather than just used in the Third Meditation of the *Meditations on First Philosophy*:

First, however, considerations of order appear to dictate that I now classify my thoughts into definite kinds, and ask which of them can properly be said to be the bearers of **truth** and falsity. Some of my thoughts are as it were the images of things [*tanquam rerum imagines*], and it is only in these cases that the term "idea" is strictly appropriate – for example when I think of a man, or a chimera, or the sky, or an **angel**, or **God**. (AT VII 36–37, CSM II 25–26)

This passage continues by noting that some thoughts have "additional forms," which include volitional aspects. So *all* modes of thought include an ideational aspect in the "strictly appropriate" sense, while some include volitional aspects as well (AT VIIIA 17, CSM I 204; cf. AT III 295, CSMK 172). That contrast is important in the Fourth Meditation's theodicy of error (see **error, theodicies of**). The quoted Third Meditation passage goes on to introduce the question of truth and falsity:

Now as far as ideas are concerned, provided they are considered solely in themselves and I do not refer them to anything else, they cannot strictly speaking be false; for whether it is a goat or a chimera that I am imagining, it is just as true that I imagine the former as the latter.

Ideas are not themselves true or false "strictly speaking." Descartes will, however, later allow that, less strictly speaking, ideas that are not clear and distinct (see **clarity and distinctness**) can be regarded as **materially false** when they provide subject matter for erroneous judgment (AT VII 232–33, CSM II 163; see Wilson 1978, ch. 5; Alanen 2003, ch. 5; and Nelson 1996). In the context of the Third Meditation, clear and distinct ideas are brought in as a part of the technical means of establishing the **existence** of God. Here it is important to note that while all ideas are, "as it were," images, clear and distinct ideas of **essences** are purely intellectual and involve no corporeal images. Descartes explains in Third Replies that he chose the term "idea" because "it was the standard philosophical term used to refer to the forms of **perception** belonging to the divine mind, even though we recognize that God does not possess any corporeal **imagination**" (AT

VII 181, CSM II 127–28). The procedure of the Third Meditation’s **cosmological argument** further requires an explicit classification of ideas according to their formal and objective reality (see **being, formal versus objective**). Their formal reality is simply their existence as modes of thought. Objective reality is connected with **representation** and intentionality. Descartes argues that because the idea of God includes an actually infinite degree of objective reality, it represents a formal – that is, actually existing – infinity of reality. Along the same lines, the cosmological argument depends on there being exactly three degrees of objective reality: infinite, finite substantial, and modal (AT VII 185, CSM II 130).

The connection between representation, especially the representation of extramental objects, and objective reality is one of the most difficult parts of Descartes’ theory of ideas; it has accordingly led to divergent interpretations. One class of interpretations can be approached from the **definition** of “idea” in the **Geometrical Exposition**. The definition, like the Third Meditation, adverts to the notion of form:

I understand this term to mean the form of any given thought immediate perception of which makes me aware of the thought. Hence, whenever I express something in words, and understand what I am saying, this very fact makes it certain that there is within me an idea of what is signified by the words in question. (AT VII 160, CSM II 113)

This leads to the next term defined in the Geometrical Exposition, “objective reality”:

By this I mean the being of the thing which is represented by an idea, in so far as this exists in the idea.... For whatever we perceive as being in the objects of our ideas exists objectively in the ideas themselves. (AT VII 161, CSM II 113–14; cf. AT VII 102, CSM II 74–75)

This is ambiguous. It could mean simply that the term “objective reality” indicates that an idea represents some object – usually an extramental object. This object has its own formal reality and that formal reality is what is represented in virtue of the idea’s objective reality. In short, “‘objective being’ simply means being in the **intellect** in the way in which objects are normally there” (AT VII 102, CSM II 74). A different reading suggested to some by the wording of the definition understands Descartes not only to be using medieval terminology but to be deeply indebted to medieval theories of cognition. In these theories, an object can have two sorts of being, formal being and objective being. These two “modes” of being correspond to the way things exist in the **mind** and the way the very same things exist outside the mind (see, e.g., Alanen 2003, 122–37, and Brown 2008, 198–202). Descartes’ own

explication of the passage just quoted from First Replies immediately follows it and supports this reading, especially in the first clause:

By this I mean that the idea of the sun is the sun itself existing in the intellect – not of course formally existing, as it does in the heavens, but objectively existing, i.e. in the way in which objects normally are in the intellect. (AT VII 102–3, CSM II 75)

In such theories, it would be unacceptable to say that God literally exists in the mind or the mind itself has a second sort of existence in the mind, so this reading is meant to apply to adventitious sensory ideas but not to innate ideas (see Ayers 1998 and Carriero 2009, 11–21).

The rival reading of these texts has Descartes diverging more sharply from medieval theories. Instead of putting weight on a medieval notion of form, *representation* is instead emphasized and taken to be intrinsic to thought. Consequently, the representational, or objective, feature of thought is what individuates one idea from another as modes of thought. Ideas “form” thoughts, thereby particularizing them, but only insofar as representations are distinguished from one another (see Lennon 1974).

Stressing the representational character of ideas helps absolve Descartes of the charge that he failed fully to excise Aristotelian devices from his philosophy. Focusing on representation, however, puts pressure on the **analogy** between ideas and images. On one reading, ideas are (as it were) imagistic *objects* that are perceived by the mind in a separate *act* or *operation*. It is as if the “mind’s eye” examined ideas to ascertain their content. Some support for this might be found in the preface to the *Meditations* where Descartes distinguishes ideas taken “materially,” that is, as operations, from ideas taken objectively (AT VII 8, CSM II 7). If that is not the same as the closely related formal-objective distinction, it could seem to entail that extramental objects are cognized by the mind, or perhaps the mind’s eye, indirectly by the mediation of ideas (see Kenny 1968, ch. 5, and Newman forthcoming). A variation on this theme makes the operation and the representation different aspects of one and the same idea (Chappell 1986, Smith 2005). In that case, the perception of extramental objects would be mediated by the objective aspect of the idea. Yet another reading takes ideas themselves to be perceptive acts, so cognition of extramental items is unmediated and direct (see Nadler 2006). The fundamental issue of the directness of perception, unresolvable by straightforward examination of Descartes’ writings, concerns the fine-grained details of the modal distinction as it applies to thought itself (see **distinction [real, modal, and rational]**). If perceptions consist of acts and objects that are sharply individuated, separate modes, then there is a clear sense in which cognition of extramental objects is indirect. If, however, there is no more than a theoretical or rational distinction between act and object, then the issue might be

merely terminological. Ideas could be regarded as having both active and passive aspects, and depending on the question at hand, either could receive the theoretical focus (Nelson 1997).

A further important classification of ideas is tentatively characterized in the Third Meditation:

Among my ideas, some appear to be innate, some to be adventitious and others to have been invented by me [*factae*, i.e. “factitious”]. My understanding of what a thing is, what truth is, and what thought is, seems to derive simply from my own nature. But my hearing a noise, as I do now, or seeing the sun, or feeling the fire, comes from things which are located outside me, or so I have hitherto judged. Lastly, sirens, hippogriffs, and the like are my own invention [*finguntur*]. (AT VII 37–38, CSM II 26)

Descartes is most appropriately characterized as a rationalist not because he denigrated **sensation** (he did no such thing) but because he held that the fundamental principles of knowledge and **reason** are innate to the mind. Throughout his career, he highlighted the importance of what is innate, native, inborn, implanted (as seeds), primitive, or primary to the mind (see, e.g., AT X 373–76, CSM I 17–18; AT XI 47, CSM I 97; AT VI 41, CSM I 131; AT VIIIB 166–67, CSMK 222; AT III 665–68, CSMK 218–19; AT III 691–92, CSMK 226–27; AT IXB 14, CSM I 186; and the subsequent quotations in this entry). It is not surprising then, that understanding Descartes’ doctrine of innate ideas is crucial for understanding adventitious and invented ideas as well. By the end of the Third Meditation, it is made clear that the idea of God is innate. “And indeed it is no surprise that God, in creating me, should have placed this idea in me to be, as it were, the mark of the craftsman stamped on his work” (AT VII 51, CSM II 35). In the preface to the *Principles of Philosophy*, Descartes explains that there are only three foundational principles or innate ideas: one’s own thought, God, and **extension** (AT IXB 10, CSM I 184; see Nelson 2008 for discussion and some reasons for thinking that the idea of the **human being** is a fourth foundational innate idea). In the preface to the *Principles*, Descartes states that an important feature of these three is that all of his **metaphysics** can be clearly and distinctly deduced from them. This makes the exact count of ideas called “innate” indeterminate.

Because innate ideas can be clearly and distinctly perceived, their objects are **true and immutable natures**, and they yield knowledge of **essences** (see Nolan 1997 and Cunning 2003). This is connected with innate ideas being simple and indivisible; conversely, ideas that are complex are ultimately composed of innate ideas. These doctrines first appear in the early, unpublished *Rules for the Direction of the Mind*. There he writes of **simple natures** being intuited instead of ideas

being clearly and distinctly perceived, but the variation is mostly terminological. On this point, it is arguable that Descartes' writings are continuous from early to late (Marion 1999, 20–42). In Rule 8, for example, we find that “there can be no falsity save in composite natures which are put together by the intellect” (AT X 399, CSM I 32). This is a striking anticipation of the famous analogy with painting in the First Meditation. Descartes there compares a painter's creating fantastic composite representations from the simple elements of shapes and colors. Dream **doubt** there applies to all complex sensory perceptions because they might be as unrealistic as the painter's inventions. But an even more hyperbolic form of doubt is required to raise any question about whatever very simple perceptions we might have (AT VII 19–20, CSM II 14–15).

The connection between innate ideas, simplicity, and truth is exploited throughout Descartes' writings. Rule 12 contains a particularly clear, early statement:

Simple natures are all self-evident and never contain any falsity. This can be easily shown if we distinguish between the **faculty** by which our intellect intuitively knows things and the faculty by which it makes affirmative or negative judgments.... it is evident that we are mistaken if we ever judge that we lack complete knowledge of any one of these simple natures.... otherwise it could not be said to be simple, but a composite made up of that which we perceive in it and that of which we judge we are ignorant. (AT X 420–21, CSM I 45; cf. AT X 399, CSM I 32)

The reference to judgment here is very important. The point is that when innate ideas are considered separately, the resulting perceptions are clear and distinct. But there is a danger of falsity when ideas are combined into complex judgments. In fact, confused and obscure ideas are produced in precisely this way. Ideas become fused together, “con-fused” (*confusus*) by judgments so that they can be mistakenly regarded as unities. This can result in further false judgments. The problem is minimized when the relations among components of composite ideas remain clear and distinct, as in mathematical demonstrations, for example. But the danger is particularly acute when these judgments involve affirmations about extramental reality. This insight from some of Descartes' earliest writings is found again in the Sixth Replies:

It happens in almost every case of imperfect knowledge that many things are apprehended together as a unity, though they will later have to be distinguished by a more careful examination. (AT VII 445, CSM II 300; cf. AT VII 147, CSM II 105)

And we find it yet again in a letter to **Mersenne** written after the *Meditations* in 1641:

But I explained in my Reply to the First Objections how a triangle inscribed in a square can be taken as a single idea or as several. Altogether, I think that all those which involve no affirmation or negation are innate in us; for the sense-organs do not bring us anything which is like the idea which arises in us on the occasion of their stimulus, and so this idea must have been in us before. (AT III 418, CSMK 187)

Commentators have had difficulty discerning a coherent account of innate ideas in Descartes' writings (McRae 1972; Wilson 1978, 152–65; Jolley 1990, 12–54). If innate ideas are clearly and distinctly perceived, does this mean that infants do so? If they are instead perceived only when appropriately occasioned, does that mean that they are irreducible, occult dispositions of the sort that later philosophers learned to distrust? Perhaps Descartes would have answered these questions by appealing to the way in which confused ideas – those of infants, for example – are composed of simpler, innate elements. It follows that one would always be aware of ideas that included innate ideas as components, but one might never come to perceive innate ideas clearly and distinctly. Doing so would require literally *distinguishing* them from the other confusing elements. Converting confused ideas into clear and distinct perceptions typically requires meditation and the application of analysis and the **method** of doubt (AT VII 157, CSM II 111) (see **analysis versus synthesis**).

The letter to Mersenne just quoted might seem to bring out a remarkable sense in which Descartes maintained that *all* ideas are innate. Sensation results in ideas that represent existing bodies, yet Descartes' anti-Scholastic natural philosophy and **dualism** entail that nothing corporeal can be literally transmitted into a thinking thing. The letter is not aberrant; in 1648, just two years before his death, he penned this well-known passage in the *Comments on a Certain Broadsheet*:

[There] is nothing in our ideas which is not innate to the mind or the faculty of thinking with the sole exception of those circumstances which relate to experience, such as the fact that we judge that this or that idea which we now have immediately before our mind refers to a certain thing situated outside us.... The very ideas of the **motions** themselves and of the figures are innate in us. The ideas of pain, colours, sounds and the like must be all the more innate if, on the occasion of certain corporeal motions our mind is to be capable of representing them to itself, for there is no similarity between these ideas and the corporeal motions. (AT VIIIB 358–59, CSM 1 304)

The importance that Descartes' assigns to some ideas in virtue of their being innate could not be supported unless there were some adventitious and factitious ideas with

which to contrast them. A clue to Descartes' meaning is provided by passages in which he maintains that even sensory ideas can be clearly and distinctly perceived. The discussion of how sensations are known at the end of the first part of the *Principles* is crucial:

[Sensations, emotions, and appetites] may be clearly perceived provided we take great care in our judgements concerning them to include no more than what is strictly contained in our perception – no more than that of which we have inner awareness. (AT VIII A 32, CSM I 216)

We must be very careful to note that pain and colour and so on are clearly and distinctly perceived when they are regarded merely as sensations or thoughts. (AT VIII A 33, CSM I 217)

These texts do not say that colored objects or painful limbs are clearly and distinctly perceived. Those ideas are confused complexes; they are also adventitious. Instead, they can be read as saying that if we take great care and separate the simplest sensory elements from confusing judgments about bodies, we can clearly and distinctly perceive the residue of that analysis. So these simple sensory ideas are the ones that are identified as innate in the notorious passage quoted from the *Comments on a Certain Broadsheet*, and adventitious ideas of colored bodies and painful limbs involve the “circumstances which relate to experience,” that is, the human sensation of bodies.

Descartes never conclusively settles a number of difficult issues about ideas and human sense perception so commentators have had a good deal of work to do on this topic. One set of issues is brought to a head when Descartes distinguishes “three grades of sensory response” in the Sixth Replies. The first grade straightforwardly consists in the purely material operation of the human **body**. The third grade includes considerable cognitive processing. “It includes all the judgements about things outside us which we have been accustomed to make from our earliest years – judgements which are occasioned by the movements of these bodily organs” (AT VII 436–37, CSM II 294–95). The third grade of sensory response clearly involves many complicated matters, but it is easily characterized without recourse to any details about the theory of ideas. It is thus at the *second* grade of sensory response that most interpretive difficulties arise. Just before the last quoted passage we find this:

The second grade comprises all the immediate effects produced in the mind as a result of its being united with a bodily organ.... Such effects include the perceptions of pain, pleasure, thirst, hunger, colours, sound, taste, smell, heat, cold, and the like, which arise from the union and as it were the intermingling of mind and body, as explained in the Sixth Meditation.

The “immediacy” of the ideas at this second grade evidently consists in the absence of judgment or reasoning. The passage continues with an example of visual perception:

[The second grade] extends to the mere perception of the colour and light reflected.... it arises from the fact that the mind is so intimately conjoined with the body that it is affected by the movements which occur in it. Nothing more than this should be referred to the sensory faculty if we wish to distinguish it carefully from the intellect.

It is thus an ineffable consequence of the union of mind and body that the second grade of response in the mind arises from the first grade of response in the human body. Descartes might be committed to the position that the second grade includes not only sensory ideas of, for example, color, sound, texture, and pain but also the innate idea of extension (see Wilson 1999, ch. 5). In the *Meditations* and *Principles*, this is arguably an important component of the **proof of the existence of body**. It would also help explain the representative character of the ideas at the second grade. Although the sensory content only confusedly represents material things, the extended component can be made clear and distinct. This means that it can be the basis of true judgments concerning material things. But the inclusion of extension in the second grade also highlights an important problem about the purely sensory components at that grade. It might seem they cannot represent or have objective reality at all because the motions in external bodies that effect the second grade in no way resemble those modes of thought (Wilson 1999; Simmons 1999, 2014; Nelson 2013). One might conclude that these purely sensory aspects of thought represent the mind, or perhaps instead the human being. One might alternatively conclude that they are not ideas at all, or simply that Descartes himself did not have a fully coherent theory. This last alternative inspired a good deal of the early reception of Descartes’ philosophy in such thinkers as **Arnauld, Malebranche, Desgabets, Régis, Spinoza, and Locke**.

See also Being, Formal versus Objective; Clarity and Distinctness; Falsity, Material; Imagination; Intellect; Judgment; Knowledge; Mind; Mode; Perception; Reason; Representation, Sensation; Thought; Truth

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IMAGINATION

From the beginning of Descartes' intellectual career, imagination played a major role in his writings, even when he took pains to point out its limitations and pathologies. This role is more central and apparent to those who have available the entire *oeuvre* than to his contemporaries. But even contemporary scholarly evaluations are often unduly influenced by the assumption that, in showing imagination's weakness, the *Meditations* establishes its cognitive insignificance. This assumption can lead to overlooking the fundamental importance of imagination in Descartes' **philosophy**.

Although the history of imagination is complex, one can nevertheless identify several intellectual streams influencing the early seventeenth century. Medical, Aristotelian, Platonic, and Stoic traditions agreed in conceiving imagination as a medial psychophysiological power: located midway between the deliverances of the external senses and intellectual conception, in terms of both psychology and physiology (see **anatomy and physiology**). Humanists regarded it as crucial for adapting **knowledge** to circumstances; in rhetorical theory, it was decisive for discovering topics and putting them in order. In the mathematical sciences (especially **geometry**), it played an important role in the transition between thinking natural things in place and thinking mathematical objects in abstract space. Already in late antiquity the greatest Platonist philosopher of **mathematics**, Proclus, had argued that mathematics required intellectual imagination (Nikulin 2002 and Rabouin 2009).

Descartes was introduced to the Aristotelian conception of imagination by his **Jesuit** teachers at the Collège Henri IV de La Flèche. Aristotle had argued that in **animals** the external senses were united in common **sensation**, and that the sensible forms appearing there (called *phantasms* or *images*) could be psychophysiologicaly preserved and reactivated. Moreover, in **human beings**, there was no thinking without such phantasms. Muslim philosopher-physicians like ibn Rushd (Averroës) and ibn Sina (Avicenna) and their European Scholastic followers developed from these indications rigorous accounts of the complex activity (physiological as well as psychological) of images in an expanded realm of internal sensation. This activity began in higher animals with common sensation's presentation of a world of sensory appearances; proceeded to the memorative and imaginative powers that retain, reproduce, and recombine the phantasms; and advanced to the instinctive assessment of these representations as noxious or advantageous to the animal, assessments that led to purposive behavior. In human beings, the entire process of internal sensation had a further stage: it "prepared" phantasms so that **intellect** could "abstract" from them "intelligible species" (see **species, intentional**). The ultimate act of internal sensation thus crossed over from complex image consciousness to intellectual (noetic) apprehension and rational (discursive) thinking (see **common sense**).

Descartes' earliest extant writings are full of reflections marked by these traditions. He shows a quasi-humanist commitment to both cognitive and

poetic-expressive imagination. His first version of **method** is founded on taking what is already encountered at a basic level of experience and then re(con) figuring it at a new, typically geometrical-mathematical level. In early mathematical and natural-philosophical notes, he constantly resorts to imaginative techniques of picturing problems in simple geometrical figures and imaginatively manipulating them by means of interlinked **motions**, rotations, translations, and the like. In one note, he compares this to the art of **memory** taught by rhetoric. Memory art uses arbitrarily chosen figures to help one remember, whereas the art that he teaches uses figures to express and develop in a rigorous way the proportional relations that actually exist between the elements of a problem (AT X 230). In his strictly mathematical notes, he is seeking symbolic, arithmetic-algebraic ways of expressing the results of geometrically imagined manipulations. These techniques, repeated recursively, sometimes generate complex formulas approaching a limit (see *Excerpta Mathematica*, AT X 285–324). Thus, the disciplined combination of geometrical imagining and algebraic reimagining seemed able to cope with infinity, or at least infinite processes.

The *Rules for the Direction of the Mind* aimed to ground these techniques in the regulated use of the two most basic powers of the human **mind**, intuition and **deduction**. The former immediately cognizes a result from something given (which might be either simple or complex); the latter takes the results of discrete acts of intuition and arrays them in a chain that can be surveyed in a step-by-step verification of each intuition and of an overall validation of a result that cannot be taken in at a glance. The *Rules* variously calls this survey a work of cogitation or of imagination (see AT X 369 and 388, CSM I 15 and 25).

The “secret of this art” (AT X 381, CSM I 21) lies in observing order and measure by means of creating sequences that express the proportions that hold between the elements of the problem. The easiest way is to represent them in simple figuration – simplest of all being straight-line segments and, in discursive-algebraic terms, elementary symbols representing these figures, their order or measure, and their proportional combinations. If real things typically consist of natures compounded into complex proportional relationships, the corresponding representations of them require forming compounds of simple proportionalized figures. These are subject to geometrical manipulation simultaneously tracked by symbolic algebraic representation. Any proportional relationships whatsoever, whether intellectual, spiritual, or corporeal, can be expressed symbolically and thus be subject to the imaginative method of the *Rules*. In terms defined in Rule 12, this activity is the work of the knowing power (*vis cognoscens*) in and through the organ of phantasia (AT X 413–16, CSM I 40–43) (see **native intelligence** and **common sense**).

Descartes’ physical and mathematical writings of the 1630s intensified this imaginative work, though they also more strongly emphasized that the intellect determines imagination’s fundamental parameters. Thus, the construction in *The*

World, part 6, of a simulacrum of the physical world in “imaginary spaces” with constant reference to actual imagining is preceded by the intellect’s recognition that a straight-line tendency to motion is most conformable to the consistency of **God’s** creation (AT XI 31–36, CSM I 90–92). The paragraphs following the enunciation of the four rules of method in part 2 of the *Discourse* (AT VI 19–21, CSM I 120–21) make evident that Descartes still considered the figurative **representation** and manipulation of proportions as the basis of mathematics and physical science. The dynamic mathematics of the *Geometry*, which systematically correlates geometrical curves and their continuously regulated motions with complex geometrical proportions expressed in algebraic equations, further ramifies imagination’s work.

Descartes’ post-1637 writings move both (1) to establish the boundary between imagination and intellect in metaphysical questions and (2) to integrate imagination into the total psychophysiology of the human being as more an act of will than a relatively passive **perception**.

1. Boundary Setting. The first movement is familiar from the Sixth Meditation’s argument that, whereas we can both conceive and imagine a triangle with ease, the indistinct imagining of a chiliagon does not hinder our understanding it distinctly. The meditative process of the first and second meditations suggests that precisely as thinking beings we can detach ourselves from imagining and that cognizing **wax** as a **substance** subject to myriad transformations is an act of intellect, not of sensation or imagination.

This argument is less conclusive than it initially appears, however. Descartes’ early understanding of imagination had conceived it as an action of the knowing power in the organ of phantasia, capable of forming new images and of contemplating already-impressed ones. The *Meditations’* arguments limiting imagination treat it chiefly in its contemplative aspect: insofar as it contemplates “the shape or image of a corporeal thing” (AT VII 28, CSM II 19) as the mind applies itself with special effort to the **pineal gland** (AT VII 73, CSM II 51). This is imagination as static gaze, not the active formation and transformation of shapes and images that the earlier works emphasized.

When the dynamic formative power of imagination is suppressed, it is easy to overlook, as most secondary literature does, the degree of the imagination’s involvement in the First, Second, and Third Meditations. The First Meditation, for example, deploys pathological forms of imagining to call into question the reliability of sensation and memory (see Bitbol-Hespériès 2000). The process of doubting, the malign genius, the *cogito*, the persistence of melting wax through all perceived and conceivable changes, and even the proof of God’s existence require vigorous imagining to set the stage for intuitions that apprehend truths by a movement of thought away from an original posit. This is the method of *remotio* that was employed in medieval “negative theology” and was well known to Scholastic thinkers. Although

the *Rules* has no direct discussion of how the knowing power acts on its own, the few examples Descartes gives (e.g., in Rule 14's treatment of abstraction) show pure intellect to work by moving away from something finitely or at least determinately posited. It negates and draws limits, as when we hold in mind an image of a **body**, an extended thing, and note that **extension** per se is other than being a body (AT X 444–45, CSM I 60–61). Recognizing this is not *having* a specific image before the mind, nor is it the deliberate or accidental *variation* of it. Yet one can hardly have the “pure intellection” without imagining the relevant thing and then mindfully moving away from it. In conceiving extension as different from body, the intellect acts in the imagining by moving beyond it. The truth is related to, but other than, having the image. This may be psychologically subtle, but it goes a long way toward establishing what Descartes meant when he talked of intellection apart from imagination.

Accordingly, Nolan has pointed out the surprising fact that the Fifth Meditation qualifies the Fourth Meditation's doctrine that distinct perception is proper to pure intellect by turning back to imagination. Quantity “is something I distinctly imagine [*distincte imaginor, j' imagine distinctement*]. That is, I distinctly imagine the extension of the quantity (or rather of the thing that is quantified) in length, breadth, and depth” (AT VII 63, CSM II 44). Although Descartes' immediate aim is to distinguish the various objects of knowledge rather than to present psychological theory, in the last analysis this suggests that, far from excluding imagination from distinct perception, he is instead explaining intellectual perception by “distinguishing two aspects of a single *distinct imagining*” (Nolan 2005, 239–40; emphasis in original).

2. Human Integration. The second movement of Descartes' post-1637 thinking about imagination appears most clearly in his correspondence with **Princess Elisabeth** and in his final work, the *Passions of the Soul*. For example, to Elisabeth he remarked that he “count[s] among the exercises of the imagination all serious conversations and everything that requires attention” (AT III 693, CSMK 227). In the *Passions*, imagination is portrayed as an action of will, the active side of thinking proper, whereas perception, whether intellectual, imaginative, or sensory, is passive and thus of subordinate importance in understanding **thought** and **human being** (AT XI 343–44, CSM I 335–36). The *Passions* articulates a psychophysiology combining passions and emotions with sensation, imagination, and memory in a unified system of pineal gland and **animal spirit** flows.

What is needed in the future is careful scholarship regarding these distinctions. Such work will likely require a fundamental rethinking of Descartes' philosophical psychology (including the question of what *cogitatio* is) and its overall place in his philosophy.

See also Common Sense, Deduction, Intellect, Memory, Mind, Native Intelligence, Passion, Perception, Pineal Gland, *Rules for the Direction of the Mind*, Sensation, Thought

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DENNIS L. SEPPER

INDIVIDUATION

Imagine, one next to the other, two otherwise identical objects. The problem of **uni-versals** concerns what it is in virtue of which the two objects are *identical*. The problem of individuation, on the other hand, concerns what it is in virtue of which the two objects are *distinct*. Although these correlative problems of qualitative sameness and numerical difference generally received reduced attention in the early modern period, they were not entirely eclipsed and were never without the structural importance they had in previous periods. The position that philosophers of any period take on these problems, even just implicitly, determines much of the rest of what else they say. Descartes is no exception, though how that is so can be only suggested here. More problematically, the question of just what Descartes' position itself is has generated a great deal of disagreement, especially over whether he is a pluralist, recognizing the individuation of many corporeal *substances*, or a monist, recognizing just one. (The references at the end provide an entrée to the literature; also see **substance**)

Just by the contrapositive of **Leibniz's** principle of the identity of indiscernibles, qualitative difference is sufficient for numerical difference: (qualitative) discernibility entails (numerical) difference. So, the property-dualist Descartes has no problem individuating **minds** with respect to bodies and conversely. The problem lies with individuating minds against each other, and with individuating bodies against each other (and all of them against **God**, though that problem will be addressed here only very obliquely).

Like “substance,” the term “**body**” is for Descartes ambiguous – in fact, multiply so (AT IV 166, CSMK 242). The different senses of body might be thought of as picking out things existing on different levels (and the different levels themselves might be thought of in different ways; see Sowaal 2004). A focal text with respect to the individuation of body is the Synopsis of the *Meditations*, where Descartes distinguishes three levels of body, apparently with three different principles of individuation (AT VII 14, CSM II 10). First, there is body “taken in the general sense” (*corpus in genere sumptum*). Descartes does not mean a nonspecific body in the sense of a body taken at random. Rather, he means body as a kind. He says of body in this sense that it is a substance, the one substance that is the entire physical world (Nelson and Smith, 2010). It might be thought of as the thing that God creates when he makes **geometry** true by giving it an object (space or body). Like all substances, in any case, body in this sense is incorruptible and would cease to exist only if God withdrew his concurrence with its **existence** (a sort of passive annihilation of it) (see **concurrence versus conservation, divine**). Such exalted status is what one would expect of a kind. In the *Principles* I.53, we learn just what kind it is – the kind had by all individual bodies as their principal **attribute**, namely **extension** (again, the object of geometry) (AT VIIIA 25, CSM I 210). Insofar as it is a kind, body in this sense is individuated from other kinds in the way that any kind numerically differs from any other kind (however that might be). God too would be individuated in this way, indeed as the only substance in the strict sense of being independent of all else.

A second sense of body is the individual human body, which “insofar as it differs from other bodies, is simply made up of a certain configuration of limbs and other accidents of this sort.” To use the language of the *Principles*, the status of a human body, and presumably of all other bodies, is “modal” (see **mode**). This is by way of contrast both to body in the general sense and to the human mind, which is a “pure substance” (AT VII 10, CSM II 14). The individuation of a human body might be viewed in terms of the suitability of its configured accidents for a union with the mind that “informs” it to yield a **human being**. The idea is that some parts and some relations among the bodily are necessary in order to sustain a human life. So, the human body might survive the loss of a limb but not the loss of its **heart**. And in surviving the loss of a limb, it does so as the same body, united with the same soul. Obviously, according to Descartes, even the dramatic increase in size from infancy to adulthood does not result in a numerically different body.

Such persistence of numerical identity through change is not to be found in nonhuman bodies, which are modal beings without anything like a mind informing and unifying them as individuals. Any change in a nonhuman body ipso facto yields a different body. Bodies cannot be individuated by their simplicity as so many substances because all matter is infinitely divisible (see **divisibility**). Instead, it is the common **motion** of its parts that individuates a body from otherwise homogeneous matter. An individual body is as much of matter as moves together (AT VIIIA 53,

CSM I 233) (see **body**). If in transit a body gains or loses parts, thus changing size or **shape**, it is thereby a different body. The specific configuration of a body's accidents, whatever it might be, constitutes its identity.

The role of motion in this account is central. It is not obvious, however, how the motion of a part of matter is possible. In the ancient world, the Eleatics argued that motion is inconceivable since it involves thought about what is not, a body coming to be later where it is not now. What is, is, and there is no room for what is not. The atomists tried to respond by making room, at least for motion, by means of the void (see **atom** and **vacuum**). A body can move to a different **place** because there is a place for it that is empty. Descartes' **physics** might appear to be atomist, but only to the extent that his laws of motion are idealized to perfectly hard bodies moving in the void, an abstract situation that never obtains (see **law of nature**). Metaphysically, Descartes is a plenist insofar as body is really identical to the space that it occupies (see **plenum**). Their extension is one and the same. There can be no unoccupied space, for that would mean that there could be extension that was the extension of nothing. So, there is no void, and whatever his account of motion, it cannot be the atomist account.

With the arrival of the new mechanistic science, which explained all physical change in terms of the **mathematics** of matter and motion, the nature of motion itself became an issue. Descartes joined the debate by rejecting the reigning conceptions as ambiguous or meaningless. Instead he defined the motion of a stone, for example, as change in the external place or situation of the stone – namely, the complex of its relations to other things taken to be at rest, in particular those in immediate contact with it. More strictly, the motion occurs relative to the surface, or superficies, which is common to the stone and surrounding bodies, but which is not taken to be a part of any of them. The superficies is a mode that can be taken to be a mode of the stone or of the surrounding bodies (AT IV 164, CSMK 241–42). Motion in the stone occurs when it loses one superficies and gains another. The suggestion is of a peg being moved from one slot in a perforated board to another, or of different boards being applied to the same peg considered at rest. But this suggestion must be mistaken. For the stone is really identical to the space that it occupies – what Descartes calls internal **place** (AT VIIIA 46, CSM I 227), namely the volume “within” the superficies, of which the superficies is a mode, and apart from which, therefore, it cannot exist. The stone cannot be replaced without its space being replaced, and similarly for the surrounding bodies, but this seems impossible. The upshot would be that Descartes is committed to the Eleatic denial of real motion. One dramatic solution would be to construe motion, as did the Eleatics, as phenomenal only, which for Descartes would mean that motion occurs only with change in such sensory qualities as color. In terms of the example of the piece of **wax** in the Second Meditation, the substance known only by “purely mental scrutiny”

would be body taken in the generic sense. The individual piece of wax would be body in the sense individuated by different sensory qualities in the way a sequential turn signal individuates the direction arrow. Nothing really moves, and there are no such individuals, independently of our perceptions.

The individuation of minds is very different from the individuation of bodies, at least with respect to what is individuated. It seems clear that by contrast to individual bodies, which are configurations of accidents, individual minds are substances. This is to say that individual minds are independent of each other, since they can be conceived apart from each other and are thus really distinct from each other (AT VIII A 24, 28; CSM I 210, 213). But one wants to know what it is about an individual mind in virtue of which it is independent, distinct, and conceivable apart, especially since substance is not known, not even by the individual mind of itself, as an existing thing, because that by itself “has no effect on us” (AT VIII A 24–25, CSM II 210). We know it only inferentially through an attribute, which in the case of the mind is, of course, **thought**. But this attribute is the principle attribute of all minds and thus cannot ground the numerical difference among them.

One way to individuate minds would be to restore the ontological parallel between minds and bodies by construing Descartes’ claim that minds are substances as deploying a less than strict sense of the term “substance,” thus allowing correspondingly as many senses of mental individuals as there are physical. This was the tack taken by **Pierre-Sylvain Régis**, who committed himself to the view that individual minds consist of their thoughts as individual bodies consist of their modes of extension, with the result that if there is any basis for accepting personal immortality, it can come only from faith and not from **reason**. “As extension which is the essential attribute of body is never corrupted, and it is only the modes making it this or that body that perish, we are forced also to recognize that thought, which is the essential attribute of mind cannot be corrupted. And it is only the modes determining it to be this or that soul, for example to be the soul of Peter, Paul, etc., which are destroyed” (quoted in Lennon 1994, 28). Souls are individuated as so many different bundles of modes, but not in perpetuity.

Now Régis had credentials that ought to have made his Cartesian authority and orthodoxy impeccable. Yet in this case he failed, in both theological and philosophical terms. For the conclusion that Descartes immediately draws from the status of the individual mind as a substance is its immortality. “It follows from this that while the body can very easily perish, the mind is immortal by its very nature” (AT VII 14, CSM II 10). And by this consequent immortality he cannot mean that merely of the principal attribute, for, in the dedicatory letter to the Sorbonne, he takes himself to be obeying the Lateran Council, which condemned the Averroist view of an only impersonal immortality and instructed philosophers to refute that heresy with their arguments (see **soul, immortality of**).

Another possibility might be to ground the individuation of minds in the reflexive nature of Cartesian thought, whereby one is aware not only of the thought, say the sun, but also of the self having that thought. While such transparency of thought to itself is an important Cartesian concept, it seems inadequate to individuate minds. For one still wants to know what the ground is for the individual self of which one is always aware in any thought.

Another possibility, no less connected to central Cartesian themes, is to look for the individuation of a mind in the substantial union it has with the body (see **human being**). This late notion of Descartes' might be thought of as his version of Aquinas's solution to the same problem. Unlike **angels**, who differ numerically just because they are all of a different nature, human beings are all of the same nature; so they differ because they are individuated by different matter. That is, it is the soul-body hylomorphic compound that is immortal, not just the soul. So, for Descartes, the immortality of the individual soul might be ontologically parasitic on that of the body to which it is substantially joined. This union itself has proved to be obscure, however, with Descartes burying the obscurity by calling it a **simple nature**, and thus in the end it does not help much in accounting for the individuation of minds. Moreover, the dependence of individuation is in the other direction: mind individuates body (AT IV 167, CSMK 243).

See also Attribute; Body; Divisibility; Extension; Human Being; Mind; Mode; Motion; Place, External versus Internal; Régis, Pierre-Sylvain; Shape; Soul, Immortality of the; Substance; Thought; Universal

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THOMAS M. LENNON

INERTIA

The term “inertia” was first introduced by **Kepler** (*Epitome of Copernican Astronomy*, IV.3, 59; IV.2, 54, 55) to designate the opposition to **motion** that he considered natural to matter. One component of this opposition was a variant of Aristotelian doctrine about “violent motion” that **Galileo**, **Gassendi**, **Beeckman**, and Descartes would reject: persistence of motion requires some external agent, because **bodies** in motion tend toward rest. Although the Keplerian concept of inertia is sometimes erroneously identified with this first component alone, Kepler’s view included a second component claim, a variant of which future **physics** would retain: bodies resist being put into motion, and their resistance varies with density (Kepler 1858 and 1896, 1:161; 6:174–75, 342; Jammer 1961, 57, 56, 55).

Descartes uses the term “inertia” much as Kepler did. In response to **Debeaune’s** claim that resistance is due to a *tardiveté naturelle*, Descartes denies that bodies possess any such natural inertia or sluggishness. His own view emerging, he too acknowledges resistance, though correlating it with size rather than density, as his **definition** of matter in terms of **extension** alone demands. Diverging from Kepler, he pairs his recognition of resistance with the anti-Aristotelian claim that bodies in motion tend to stay in motion (AT II 466–67).

The term “inertia” eventually labeled a principle based upon **Newton’s** first law of motion, which states, “Every body perseveres in its state of being at rest or of moving uniformly straight forward, except insofar as it is compelled to change its state by **forces** impressed” (*Principia*, 417). The concept of an inertial state is inseparable from such concepts as space and motion, and whereas Newton saw rest and uniform motion as distinct if humanly indistinguishable states, they were eventually classified as distinct only in connection with a chosen reference frame.

Although Newton himself did not call his first law the “law of inertia,” the appellation is perhaps apt because he grounded all three laws of motion in the *vis inertiae* or **force** of inertia, a power of resisting inherent to matter (*Principia* 404–5; *Opticks*, Query 31, 401). The first and second laws are related through the *vis inertiae*, resistance to acceleration being proportional to mass or quantity of matter; and in the limiting case of a body subjected to impressed forces summing to zero, the body persists in its state – insofar as it can (*quantum in se est*) – as described by the first law. (On the Cartesian heritage of the phrase *quantum in se est*, see Cohen 1964, esp. 138; Koyré 1965, 69–70.) When exercised, however, the *vis inertiae* constitutes not only a body’s resistance to an obstacle impressing a force upon it but also its endeavor to change the obstacle’s state so as to maintain its own. This seems to imply the third law, according to which the actions of two bodies upon one another are equal in magnitude and oppositely directed.

It is often said that Descartes was the first to formulate the principle of inertia, a claim based upon his first and second **laws of nature**, as articulated in the *Principles of Philosophy*. According to his first law, “*Each and every thing, in so far as it can, always continues in the same state; and thus what is once in motion always continues to move*”; changes occur, he continues, only as a result of “external **causes**” (AT VIIIa 62–63, CSM I 240–41). The second law qualifies the kind of motion that is natural to bodies, by asserting that “all motion is in itself rectilinear” (AT VIIIa 63–64, CSM I 241–42). This was the first explicit and clearly recognized statement to that effect; although Galileo sometimes employed rectilinear natural motion, he elsewhere presented natural motion as following the earth’s horizon and thus a curved trajectory (see Hooper 1998, esp. 168–70; Machamer 2009, §3). With this second law, Descartes indicated that a body following a curved path is subject to external causes and so helped point the way toward Newton’s synthesis of terrestrial and celestial motions.

A common description of phenomena can be extracted from Newton’s first law on the one hand and Descartes’ two laws on the other (by assuming a certain reading of the second law’s second conjunct, supportable by AT VIIIa 108–111; CSM I 259–60; see Gabbey 1971, 63.) Yet Descartes’ laws, which were well known to Newton, are situated in a very different theory, and as some commentators have argued, it is important to distinguish between their descriptive and theoretical meanings (see Blackwell 1966 and Gabbey 1971). The grounds for Descartes’ laws are explicitly metaphysical. The first law follows from his conservation principle that the universe always contains a fixed quantity of motion (understood in terms of speed and size rather than velocity and mass), for that quantity would not be constant if bodies tended toward rest; and the conservation principle follows from **God’s** immutability (see **conservation of motion, principle of**). The first law is additionally grounded in the Scholastic principle that nothing tends toward its own opposite or destruction; and since motion and rest are opposites, a moving body cannot tend toward rest. The external causes that can disrupt a body’s state are not Newton’s quantifiable impressed forces, and Descartes has no analogue of Newton’s second law, such that an inertial state could be a limiting case. He seems to presage Newton’s third law, by claiming that an action considered with respect to one subject is a **passion** considered with respect to another (AT XI 328, CSM I 328), but the claim remains qualitative. There is no concept of inertial mass, resistance being construed in terms of a body’s size. The theoretical meaning of Descartes’ two laws is thus quite different from that of Newton’s first law and the principle of inertia based upon it. Nevertheless, their descriptive meaning was historically influential.

See also Cause; Conservation of Motion, Principle of; Force and Determination; Kepler, Johannes; Law of Nature; Motion; Newton, Isaac; Physics

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HYLARIE KOCHIRAS

INFINITE VERSUS INDEFINITE

Descartes relied heavily on the **idea** of infinity, most crucially in his first **cosmological argument** for **God’s existence** in the Third Meditation. He argues that my idea of God’s infinity is not derived by negating my own finitude nor by extrapolating from my own limited intellectual growth; on the contrary, my **perception** of the actually infinite is prior to my perception of the finite and the merely potential. Moreover, this idea is “utterly clear and distinct” and contains maximal objective

reality (AT VII 46, CSM II 31) (see **clarity and distinctness**). So it can only have come from a **substance** that contains infinite formal reality – that is, God (see **being, formal versus objective**).

God alone is strictly infinite. Yet there are created beings, like **extension** and numbers, which are unlimited in certain respects. So Descartes introduces a technical distinction between the infinite, “that in which no limits of any kind can be found,” and the indefinite, that in which “there is merely some respect in which I do not recognize a limit” (AT VII 113, CSM II 81; cf. AT V 355–56, CSMK 377). The distinction is ontological in the first instance; it concerns the degree of limitlessness in things. An ordinary **body**, for example, is limited in size but unlimited in **divisibility**. The extension of the universe beyond the earth and stars, which Descartes sometimes calls “imaginary space,” is unlimited in size but limited in power, intelligence, and the like (AT III 274–75, CSMK 166). But Descartes also emphasizes an epistemic side to the distinction. Infinite things are those that I “understand” to be absolutely unlimited (in all respects), while indefinite things are those in “which, from some point of view, we are unable to discover a limit.” Extension, for example, is indefinite because “no imaginable extension is so great that we cannot understand the possibility of an even greater one” (AT VIIIA 15, CSM I 202). But I understand God to be actually infinite “so that nothing can be added to his perfection” (AT VII 47, CSM II 32).

Importantly, a thing being indefinite in the epistemic sense entails not its being either infinite or finite in itself, in the relevant respect, but only that we do not understand it to be limited. That an indefinite thing might, on the one hand, turn out to be finite in itself is suggested in a 1647 letter to **Chanut**: “Having then no argument to prove, and not even being able to conceive, that the world has bounds, I call it indefinite. But I cannot deny on that account that there may be some reasons which are known to God though incomprehensible to me; that is why I do not say outright that it is infinite” (AT 52, CSMK 320). That an indefinite thing might, on the other hand, turn out to be infinite in itself is suggested in a 1649 letter to **More**. Descartes observes that while God alone is the only thing we understand to be positively infinite, as for the extension of the world and the parts of matter, “I confess I do not know whether they are absolutely infinite; I only know that I know no end to them and so looking at them from my point of view I call them indefinite” (AT V 274, CSMK 364). Even in the case of God, although I clearly and distinctly understand his actual infinity, I do not “grasp” it since it is in the nature or definition of the infinite not to be grasped by finite beings. By analogy, we can be said to “see” an ocean from the shoreline even though our vision “does not encompass its entirety” (AT VII 113, CSM II 81).

There are clear similarities between Descartes’ infinite-indefinite distinction and the influential Aristotelian distinction between the actually and potentially

infinite. If something is merely potentially infinite, then Descartes would label it “indefinite” (in the epistemic sense). But, as just noted, it does not follow that a thing indefinite in this sense is not actually infinite in itself. Thus, although Aristotle and Descartes agree that all matter is potentially or indefinitely divisible, that is, continuous, Descartes allows that it might, at the same time, be known to be actually infinitely divided. In a late correspondence with More, mentioned earlier, he cites a passage from his own *Principles of Philosophy* indicating that “such indefinite division of certain parts of matter sometimes actually takes place” even if we can’t conceive of it (AT V 274, CSMK 364). The passage in question (*Principles* II.34) explains how in order for matter moving circularly to pass through a narrowed space “what happens is an infinite, or indefinite, division of the various particles of matter; and the resulting subdivisions are so numerous that however small we make a particle in our thought we always understand that it is in fact divided into other still smaller particles” (AT VIIIa 59–60, CSM I 239).

So, despite our inability to grasp actual infinities, Descartes believes that both theology and natural philosophy require their existence. He is dismissive of the alleged “paradoxes” of actual infinities – for example, is the number of an actual infinity even or odd? – that were frequently invoked by medieval philosophers in support of doctrines like atomism and the noneternity of the world. When **Burman** presses him on the latter issue, noting that creation from eternity would imply an actual infinite, Descartes replies that this is no more problematic than an actually infinite future (AT V 155). Indeed, he considers it a paramount virtue of his “indefinite” notion that it allows us to sidestep such “tiresome” disputes: “We should never enter into arguments about the infinite. Things in which we observe no limits ... should instead be regarded as indefinite” (AT VIIIa 14, CSM I 201).

Although the infinite-indefinite distinction was upheld by Descartes’ most loyal followers, such as **Rohault**, the more common response was that the distinction is merely subjective and therefore without philosophical or scientific significance. Thus, a young **Leibniz** (1975, 139) observed that “the indefinite of Descartes is not in the thing but in the thinker.”

See also Body, Cosmological Argument, Divisibility, Extension

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INTELLECT

In the Fourth Meditation, Descartes introduces a distinction between two basic **faculties** of the **mind**: the *intellectus* or intellect (translated as "entendement" in the French version of 1647 and sometimes as "understanding" in English translations), by which we perceive the ideas or propositions that are the subjects of possible **judgments**, and the will, by which we judge that propositions are true or false (AT VII 56, CSM II 39). We are exercising the intellect whenever we perceive **ideas**, whether they derive from sense experience or **imagination** or are instead innate ideas apprehended independently of the senses in what he calls either "pure understanding" (*pura intellectio*) (AT VII 15, 72; CSM II 11, 50) or perceiving by the "intellect alone" (*solo intellectu*) (AT VII 34, CSM II 22). For Descartes, the intellect is not a separate faculty from **sensation**, as in **Scholasticism**. In his new conception of the mind as **thought** or consciousness, sensation comprises both a bodily process and a mental having of ideas, and thus it too involves an exercise of the intellect, though not of course a pure exercise of intellect alone.

The distinction between intellect and will builds on the Third Meditation's distinction between two kinds of thoughts: ideas, which are "as it were the images of things," and thoughts containing "certain additional forms," namely acts of will, including judgments, that involve various attitudes we can take up toward ideas, such as fearing, wishing, affirming, or denying (AT VII 37, CSM II 25–26). As this second distinction makes plain, intellect and will, though separate faculties, are also geared to work together in that "when we direct our will towards something, we always have some understanding of some aspect of it" (AT VII 377, CSM II 259). Ideally, we ought in theoretical inquiry to affirm only those ideas which we clearly and distinctly perceive to be true, ideas that, when we attend to why they are indubitable, compel our assent (see **reason**). Error arises only when we let our will acquiesce to the less demanding products of the understanding.

It is interesting to note that Descartes did not always hold this doctrine. Although in his early *Rules for the Direction of the Mind* he also distinguishes between intellect and will (AT X 361, CSM I 10), as well as between “intuiting and knowing things” and “judging affirmatively or negatively,” Descartes assigns both these latter capacities to the intellect (AT X 420, CSM I 45). Assent is regarded as a function of the intellect, not of the will. This account is in fact more orthodox, following closely Aquinas’s discussion (*Summa Theologica*, Ia IIae, q.17, a.6). Why Descartes changed his mind is a vexed question; none of his writings explain why. One possibility is that by assigning assent to the will, and thus to human freedom, he could assimilate his **explanation** of error to the traditional explanation of sin and thereby show that **God** is no more to be blamed for the one than for the other (see Gilson 1913) (see **error, theodicies of**).

In any case, the *Rules*’ description of the first role of the intellect – “intuiting and *knowing* things” – raises a question about his later account of the intellect in the *Meditations*. Does the intellect’s function of “perceiving ideas” involve simply grasping their content, or does it also include apprehending their **truth**, even if assenting to their truth is reserved for the will? In the Third Meditation, Descartes contrasts ideas and judgments in a way that denies to the intellect that second role. Ideas themselves, he claims, “cannot be strictly speaking false” or true, whereas it is in judgments, which are the province of the will, that “truth or falsity properly consist” (AT VII 37, 43; CSM II 26, 30). This view has a number of grave difficulties. For one thing, it conflicts with other assertions Descartes makes about the intellect in the *Meditations*. We are said, for instance, to discern by the intellect the reason (*rationem*) why one proposition is true rather than another (AT VII 59, CSM II 41). This very passage talks, moreover, about how “a great light in the intellect is followed by a great inclination in the will.” Yet the natural light, here located in the intellect, is for Descartes our power of distinguishing the true from the false.

Indeed, the Third Meditation’s way of contrasting ideas and judgments makes no sense if coupled with the distinction in the Fourth between intellect and will. For if “judging” that an idea is true means, as it generally does in Descartes, assenting to the idea’s truth or affirming it as true, then it clearly depends on having perceived (through the intellect) that the proposition is true: what we assent to is the truth we have grasped. If it meant instead the very apprehension of the proposition’s truth, then judgment could not consist in an act of the will: we cannot will an idea to appear true. In short, Descartes has confused error with falsity. Ideas themselves are true or false, depending on whether they agree with their objects, and their truth and falsity must therefore be discernible by the intellect. But error consists in assenting to an idea that is actually false. It thus stems from the will, if assent itself is an act of the will. The Fourth Meditation’s thesis that the intellect strictly speaking contains

no error (AT VII 56, CSM II 39) cannot be taken to imply that the intellect is unable to perceive truth or falsity in its ideas.

See also Clarity and Distinctness; Error, Theodicies of; Faculty; Free Will; Idea; Judgment; Reason; Truth

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JANSENISM

Jansenism (*Jansenisme*) is a polemical term introduced by critics to label those sympathetic to the theological views of the Louvain theologian and later bishop of Ypres, Cornelius Jansenius (1585–1638), author of the *Augustinus* (posthumously published in 1640) (see Orcibal 1953). In the *Augustinus*, Jansenius calls for a return to the emphasis in **Augustine** on the importance of the workings of grace in the salvation of the elect, against the heretical view of Pelagius that we can obtain salvation through the use of our **free will** alone. The papal bull *Cum occasione* (1653) condemns as heretical or temerarious the following five propositions that anti-Jansenist theologians in the Sorbonne claimed to find in Jansenius's text:

1. Some of **God's** commandments are impossible for the just despite their desire and their effort to obey them, given the powers that the just now possess and also the lack of grace that makes it possible to obey the commandments.
2. In the state of fallen nature, no one ever can resist interior grace.
3. To merit or demerit in the state of fallen nature, it is not required that man be free from the necessity of willing and acting; it is sufficient for him to be free from constraint.
4. The Semi-Pelagians admitted the necessity of interior prevenient grace for all good works, even for the beginning of faith; but they were heretical in claiming that this grace is such that the human will may either resist or obey it.
5. To say that Jesus Christ died and shed his blood for all men, without a single exception, is to speak as a Semi-Pelagian.

A later bull, *Ad sacram* (1656), closes a loophole created by the fact that *Cum occasione* did not mention the *Augustinus* explicitly, in claiming that the five propositions are to be found in Jansenius's text in their condemned sense. Thus did Jansenism become a formally defined heresy within the Catholic Church.

The nineteenth-century historian of **Cartesianism**, Francisque Bouillier, has claimed that there is "a natural alliance of the doctrine of Jansenius with that of Descartes." His specific proposal is that this alliance derives from the fact that the Cartesians "make God the unique efficient cause, the only actor who acts in us," whereas the Jansenists "give everything to the grace that operates in us without us" (Bouillier 1868, 1:432–43).

Even so, it is important to keep in mind that Descartes himself was never associated with Jansenism during his lifetime, despite the fact that the *Augustinus* was published a decade before his death. The connection between Jansenism and Cartesianism is a genuinely post-Descartes phenomenon. The connection is due in large part to that fact that **Antoine Arnauld** was a powerful defender both of

Descartes and of Jansenius. However, within Jansenism there also was a significant opposition to a Cartesian reliance on human **reason**. The source of this opposition was the belief, widespread among the Jansenists and arguably present in the *Augustinus* itself, that human reason can accomplish little on its own given the corrupted state of fallen human nature. Even Arnauld, who among the Jansenists was the most supportive of Cartesianism and of the use of reason in philosophy, criticized Descartes at one point for offering an account of human freedom in his correspondence that is “full of Pelagianism” (see Schmaltz 1999).

The historical realities are thus more complex than Bouillier’s thesis suggests. There is need for caution even with respect to his proposal that the Cartesian claim that God is the only cause is naturally connected to the Jansenist emphasis on the fact that grace brings about our meritorious action. **Nicolas Malebranche** was most responsible for the perception that Cartesianism leads to the occasionalist conclusion that God alone has causal power. But Malebranche also insisted, against the Jansenists, that we have the freedom to reject divine grace. Arnauld in fact found such a view to be Pelagian, and he campaigned to have Malebranche’s works placed on the Index in Rome, which they were in 1690. For his part, Malebranche noted the irony that he was being condemned because “I have refuted the opinions that the church has condemned in Jansenius.”

See also Arnauld, Antoine; Augustine, Aurelius; Faith, Religious; Free Will; Pelagianism

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TAD M. SCHMALTZ

JESUIT

The Society of Jesus, founded by Saint Ignatius Loyola (1491–1556) and established in 1540 by Pope Paul III, aimed at promoting the salvation of both its members (the Jesuits) and the rest of humankind. Although it was not intended as an educational order, from the beginning the society was interested in providing its members with

a complete university education. Rather than adhere strictly to their vow of poverty, by 1539 the founding members of the society had decided to undertake the costs of educating some talented students who, if they qualified, would become members of the order. These young students, called "Scholastics," were initially housed in colleges near an established university where they took courses. The Jesuit college functioned as a boardinghouse and also offered some pedagogical support, such as repetitions of daily lessons and practice for disputations. Around 1545, owing to student discontent with the regular university courses, the colleges at Padua and Coimbra began to offer their own courses taught by students who had completed the coursework. Their success led to the acceptance of students outside the society (Giard 1993, 129, 133, 138–39).

Francisco de Borgia, member of the society since 1546, first proposed the establishment of a public Jesuit college in his hometown. This led to the establishment of a second kind of Jesuit institution: a college that was not affiliated with a university but which functioned independently, offering students both room and board and a complete education. In addition, students from the neighboring areas were accepted as externs and were provided with the same free education as the interns. Opening up the Jesuit schools to the general public had several advantages: it allowed the poor to gain an education as well as the rich, opposed the spread of Protestantism, and brought in much needed funds. The experiment proved so successful that the Jesuits were overwhelmed with invitations to establish schools in the 1550s (Heilbron 1982, 93). By the time of Saint Ignatius's death in 1556 there were 33 Jesuit colleges in Europe; by 1615 the number had grown to 373 (Donohue 1963, 26). The colleges also grew in size; for example, in 1584, there were no less than 2,108 students at the Collegio Romano (Fitzpatrick 1933, 26). The Jesuits soon gained the reputation of being the best educators in Europe. According to a French proverb of the time, "It is better for a town to found a college of Jesuits than to build highways and harbors" (Heilbron 1982, 93). **Francis Bacon** commented of the Jesuit colleges that "in regard of this, and some other points concerning humane learning, and Morall matters ... *utinam noster esses*, [if only they were ours]" (*Advancement of Learning* 17).

The curriculum followed the works of Aristotle and **Saint Thomas Aquinas**, as Saint Ignatius had recommended that his disciples follow Thomas in theology and, in **philosophy**, Aristotle as interpreted by Thomas. Guidelines for what should be taught were later codified; for example, the *Ratio Studiorum* of 1586 specified which questions were to be treated and which were to be omitted. In general, the most common doctrines were to be followed, usually Thomas's, but in the case of controversial questions the professor could take either side. In the Jesuit colleges (which functioned differently from the Jesuit schools at Rome, Milan, and Parma later recognized as universities), the three-year course in philosophy followed this order: the first year was devoted to logic, the second to natural philosophy, and the third to **metaphysics** (Sirven 1987, 30–31). The lectures were based on Aristotle's

texts, and all courses were taught by the same professor except **mathematics**, which, when offered, was always taught by a different professor. Under the influence of the renowned Jesuit mathematician **Christoph Clavius**, a program was established whereby the most talented students were trained in mathematics and then sent to teach courses in mathematics at various Jesuit colleges (Heilbron 1982, 94, 97).

Descartes' relationship to the Jesuits was complex. He was educated at the Jesuit College of La Flèche in Anjou, which was founded by Henry IV in 1603 and opened its doors in January 1604. Descartes began his studies there in 1604 or 1606, that is, at age of eight or ten (Baillet 1691, I, 18). He would have left La Flèche around 1614 if it is correct to assume that he spent about two years studying law in Poitiers before getting his degree. Descartes would have completed the course in philosophy during his last three years at La Flèche after having learned Latin and studied its grammar, literature, and rhetoric. In addition, La Flèche offered instruction in mathematics which explains Descartes' competency in that area (Dear 1987, 136). It is the only subject he studied at school that he praises for its **certainty** and usefulness in the *Discourse on Method*. Descartes' scathing criticisms of his education in the *Discourse* notwithstanding, in a private letter to a friend he writes that "nowhere on earth is philosophy taught better than at La Flèche" (AT II 378, CSMK 123–24).

Throughout his career, Descartes sought to have his works adopted by the Jesuits. He submitted the *Discourse* and the accompanying essays (*Dioptrics*, *Geometry*, and *Meteors*) to his former teachers for approval, recognizing that if the Jesuits considered his work important enough to be taught, then his theories would soon be discussed everywhere. In his Letter of October 1637 to Father **Noël**, Descartes underscores the innovative nature of the discoveries he made in the *Discourse* and the accompanying treatises and highlights the need for the Jesuits to teach them (AT I 455, CSMK 75). Note that Descartes does not necessarily expect the Jesuits to accept his new theories, but he counts on their desire to remain up to date and discuss his theories among those that require refutation.

The longest set of objections to the *Meditations on First Philosophy* are the Seventh Set by the Jesuit Father **Bourdin**, professor of the humanities at La Flèche from 1618 to 1623 and of rhetoric and mathematics in 1633 and 1634. Despite Descartes' contempt for Bourdin's objections, and complaints to Father **Dinet**, the head of all French Jesuits, he chooses to answer them on the grounds that Bourdin's objections may represent the views of the Jesuits as a whole (Ariew 1995, 208–11). Bourdin centered his attack on Descartes' method of doubt, arguing that it was inconsistent or flawed. On September 30, 1640, Descartes writes to **Mersenne** that he would like to reacquaint himself with the Jesuit textbooks in preparation for their objections to his *Meditations* and mentions that he remembers those of "some of the **Conimbricenses**, **Toletus**, and **Rubius**" from twenty years ago (AT III 185, CSMK 153–54). This has led to a veritable cottage industry of articles and books seeking to relate elements of Descartes' philosophy to Jesuit doctrines. But Descartes makes

it clear to Mersenne that he has no interest in pouring over “their huge tomes” and instead solicits Mersenne’s help in finding a current abstract of all Scholastic philosophy (AT III 185, CSMK 154). Hence, there is no evidence that Descartes refreshed his fading memory regarding the teachings of Toletus, the Coimbrans, and Ruvius at this stage.

Descartes did consult the *Summa Philosophiae Quadripartita* of the Cistercian monk **Eustachius a Sancto Paulo**, presumably the abstract that Mersenne recommended. Descartes was so enthralled with this work that his original plan for the *Principles of Philosophy* was to publish the tenets of **Cartesianism** alongside Eustachius’s *Summa*, which he praises as “the best book of its kind ever made” (something it is decidedly not) (AT III 232, CSMK 156). However, it served his purposes in 1640 since, at that stage, he was not interested in the subtleties of Scholastic philosophy, proclaiming instead that “It is easy to overturn the foundations on which they all agree, and once that has been done, all their disagreements over detail will seem foolish” (AT III 232, CSMK 156) (see **Scholasticism**). Even if Descartes did remember and draw on the doctrines found in the Jesuit textbooks of his youth, he was more interested in what they shared with other Scholastics than what was unique to them. Absent a comprehensive comparison of the large variety of Scholastic doctrines of this period, we are not in a position to separate uniquely Jesuit positions from views they shared with their contemporaries, and so the exact influence of Jesuit philosophy on Cartesian philosophy remains undetermined.

See also Clavius, Christopher; Conimbricenses; Eustachius a Sancto Paulo; Rubius, Antonius; Scholasticism; Suárez, Francisco; Toletus, Franciscus

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HELEN HATTAB

JUDGMENT

Descartes speaks of judgment in three closely related ways. Fundamentally, he conceives of judgment as the *act of will* in assenting to some matter (or dissenting from it), that is, affirming or denying that something is the case: "The act of judging [*actum judicandi*] itself consists simply in assenting (i.e. in affirmation or denial)" (AT VIII B 363, CSM I 307). This fundamental conception gives rise to two further notions. One is of judgment as a **faculty** – the mental faculty by which minds form judgments *qua* acts of assent: for example, "I know by experience that there is in me a faculty of judgement [*judicandi facultatem*]" (AT VII 53, CSM II 37). The other notion is of judgments as *propositions* – the propositions affirmed or denied when **minds** form judgments *qua* acts of assent: for example, "it is not easy for the mind to erase these false judgements from its memory" (AT VIII A 36, CSM I 219). The description that here follows focuses on the first, and more fundamental, of these three conceptions.

Judgments arise from a cooperation of the **intellect** and the will. According to Descartes, the mind's operations fall into two main kinds: "All the modes of thinking that we experience within ourselves can be brought under two general headings: **perception**, or the operation of the intellect, and volition, or the operation of the will" (AT VIII A 17, CSM I 204). The division of labor is as follows. The intellect is responsible for cognition of the contents that get judged. Its operation in judgment involves perception or awareness of those contents: "All that the intellect does is to enable me to perceive the **ideas** which are subjects for possible judgements" (AT VII 56, CSM II 39). The *will* is responsible for the judgmental attitudes adopted toward the contents perceived. Its operation in judgment "simply consists in our ability ... to affirm or deny" those contents (AT VII 57, CSM II 40). Though both the intellect and the will are involved, strictly speaking judgment *is* the act of will – "I assigned the act of judging itself ... to the

determination of the will rather than to the perception of the intellect” (AT VIII B 363, CSM I 307).

Potentially confusing is an ambiguity in the notions of *affirmation* and *denial*. Versions of each apply not only to acts of will, as we have now seen, but to the contents perceived by the intellect. Those contents must be of such a nature as to be affirmable or deniable by the will. Only contents that propose something fit the bill – that is, *propositional* contents, whether in the form of affirmations or denials. As Bernard Williams (1978, 182) observes, “I can assent only to something of the nature of a proposition: one believes, or refuses to believe, *that such-and-such is the case*.” (In referring to the relevant contents of the intellect as *ideas*, Descartes must therefore allow that some ideas have propositional structure [cf. Buroker 1996, 6; Williams 1978, 182].) The upshot is that the quality of being affirmative or negative applies both to the attitudes adopted by the will and to the contents perceived by the intellect – an issue of debate surrounding some early modern theories of judgment (see Curley 1978 174; Owen 2007; Williams 1978, 183; Wilson 1978, 145). The theory thus entails that for the mind merely to consider an affirmative proposition is not yet for the will to affirm that proposition. As Descartes explains the point (1643 letter to Buitendyck): “What is thus imagined and attributed hypothetically is not thereby affirmed by the will as true, but is merely proposed for examination to the intellect” (AT IV 64, CSMK 230).

Some of our judgments affirm the truth, whereas others affirm what is false. Explaining the cases of error, Descartes writes:

So what then is the source of my mistakes? It must be simply this: the scope of the will is wider than that of the intellect; but instead of restricting it within the same limits, I extend its use to matters which I do not understand. (AT VII 58, CSM II 40)

What accounts for this scope of disparity? The human intellect is very limited in what it understands. In Descartes’ view, understanding arises only from clearly and distinctly perceived ideas, yet comparatively few ideas are thus perceived (see **clarity and distinctness**). By contrast, the human will has the ability to assent even to those matters the intellect misunderstands. This explanation places the final burden of responsibility for judgment error on the will:

If, however, I simply refrain from making a judgment in cases where I do not perceive the truth with sufficient clarity and distinctness, then it is clear that I am behaving correctly and avoiding error. But if in such cases I either affirm or deny, then I am not using my **free will** correctly. If I go for the alternative which is false, then obviously I shall be in error; if I take the other side, then it is by pure chance that I arrive at the truth, and I shall still be at fault. (AT VII 59–60, CSM II 41)

There are three possible attitudes the will might adopt toward the propositional contents perceived by the intellect: *assent* or affirmation; *dissent* or denial; or a *withholding* of either assent or dissent. Only the first two entail making a judgment. The third attitude figures prominently in Descartes' epistemological program. His **method of doubt** involves a systematic withholding of judgment; the method prescribes that we "should hold back [our] assent from opinions which are not completely certain and indubitable" (CSM II 12, AT VII 18).

Descartes' views on error and responsibility are linked with his views on free will. He writes that "we have free will, enabling us to withhold our assent in doubtful matters and hence avoid error" (AT VIIIA 6, CSM I 194); he adds that "we can reasonably be praised or blamed only for actions that depend upon this free will" (AT XI 445, CSM I 384). As for his position on the nature of human free will, Descartes scholarship is divided. Some commentators interpret his account as *compatibilist* (cf. Carriero 2009, 261; Chappell 1994, 188). Others interpret it as *incompatibilist* (cf. Newman 2007; Ragland 2006).

See also Doubt; Error, Theodicies of; Faculty; Free Will; Idea; Intellect

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LEX NEWMAN

KEPLER, JOHANNES (1571–1630)

Kepler was the greatest mathematical astronomer of his generation and, with **Galileo**, the strongest advocate of the Copernican system in the first third of the seventeenth century. His determination of the elliptical orbit of Mars and his three laws of planetary **motion**, taken together with his attempt to delineate the forces that **cause** planetary motion, effectively instituted the new discipline of celestial **mechanics** (Kepler 1992 [1609]). Kepler also made major advances in **optics**. In his *Ad vitellionem paralipomena* (Kepler 2000 [1604]), he established the modern theory of vision and of the functioning of the eye as an optical device. Then, in his *Dioptrice* (1611), he significantly advanced the theory of the telescope. Descartes' intellectual debt to Kepler is deep and complex and has often been misunderstood or oversimplified.

In a rare display of candor, Descartes confessed to **Mersenne** in 1638 that Kepler had been "his first master in optics" (AT II 86). This refers, first of all, to Descartes' successful demonstration of the anaclastic properties of planoconvex lenses, following his discovery of the law of refraction of **light** in 1626–27. Descartes was stimulated by Kepler's surmise along these lines in the *Dioptrice*, where he had to employ an approximate version of the law. Equally importantly, in his *Dioptrics* (1637), Descartes transposed into mechanistic terms Kepler's revolutionary theory of vision.

However, the intellectual links between Descartes and Kepler extend further, to their overall natural philosophical agendas and results: just as Kepler was not simply an astronomer, so Descartes was not simply a mathematician or metaphysician. Descartes, like Kepler, was a bold, pro-Copernican and anti-Aristotelian natural philosopher. Both also envisioned the mathematization of natural philosophy, pursuing that aim in the form of what Descartes explicitly called "**physico-mathematics**." The goal was to revise the Aristotelian view of the mixed mathematical sciences – such as astronomy, optics, and mechanics – as merely descriptive or instrumental. These disciplines were to become more intimately related to natural philosophical issues of matter and **cause**, the details depending upon the brand of natural philosophy an aspiring physico-mathematician endorsed. This is the deeper lesson that Kepler's novel, more physicalized optics taught to the young Descartes, and what he pursued in optics and theory of light throughout his career, employing corpuscular-mechanical rather than Keplerian Neoplatonic conceptions of matter and cause (Schuster 2012, Dupré 2012).

Descartes' **vortex** celestial mechanics also illustrates his emulation and mechanization of Keplerian natural philosophical themes. The vortex theory was a serious intellectual construction, utilizing causal conceptions derived from Descartes' physico-mathematical optical work. Its genealogy can be traced back to Kepler's daring "celestial physics," the attempt to account causally for planetary motions in the

Copernican system. When, in October 1628, Descartes renewed his friendship with **Isaac Beeckman**, he found the Dutchman plowing through the works of Kepler, attempting to provide corpuscular-mechanical **explanations** for his (qualitative, rather than quantitative) celestial mechanical claims. This attempt to “correct” Kepler’s ontology and natural philosophy, from Neoplatonic to corpuscular-mechanical, provided the inspiration for Descartes, when he turned to cosmological explanation while composing *The World* (Schuster 2005, 70–72). Descartes attempted to produce better mechanistic explanations than Beeckman of planetary motions and orbital placements. Following Kepler’s lead on the dynamical importance of the sun in the Copernican system, Descartes built into his vortex celestial mechanics the idea that it is only the existence of rotating, highly agitated central stars that transforms vortices of spherical *boules* into the “locking and extruding” **machines** that account for the orbital distances and orbital stability of the various planets (Schuster 2005, 41–55). Thus, Descartes was not only borrowing aims and strategies from Kepler, but also, like Beeckman, he viewed Kepler as a rival, whose Neoplatonist, pro-Copernican natural philosophy needed to be defeated by an even more stridently pro-Copernican but mechanistic one (Schuster 2005, 76–77).

See also Beeckman, Isaac; *Dioptrics*; Light; Mechanics; Optics; Physico-Mathematics; Vortex

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JOHN A. SCHUSTER

KNOWLEDGE (*SCIENTIA*)

Scientia is knowledge both *that* and *why* certain **truths** are true. It is “knowledge why” based on principles in the light of which what is known could not *but* be true: the principles “necessitate” the things known. Described like this, *scientia* is an ideal of both premodern and early modern philosophy. There are rival Scholastic and post-Scholastic interpretations of “knowledge,” “principle,” and “necessitated” that make this way of talking about *scientia* fit into each tradition.

In Scholastic philosophy, *scientia* was understood in Aristotle’s way as knowledge of the properties of members of natural kinds based on knowledge of the **essences** of natural kinds. The properties were known by unaided observation. The essences were known by Aristotelian induction. They dawned on one over time with repeated observational exposures to specimens of a kind, and they were expressed by **definitions**. *Scientia* located natural kinds in an order of more to less general, which syllogistic **explanations** of particular explananda recapitulated (cf. *Posterior Analytics* I.2.71b9). Again, *scientia* related observed facts to the unfolding of a characteristic natural history of a natural kind. The uncharacteristic or exceptional was not a possible object of *scientia*. Or, in other words, the **causes** relevant to *scientia* were formal and final, not efficient. The ultimate constituents of nature – the elements – were qualitatively defined. Scholastic *scientia* did not set out to get underneath or above observation, and did not set out to challenge or refine ordinary descriptions of things observed. Instead, it sought to systematize ordinary qualitative observation and description, referring it to definitions *per genus et differentia* that were no less observational than what they explained.

In early modern philosophy – and, in particular, in Descartes – essences were not relative to natural kinds but to more elemental things, notably matter in its more general forms. To have *scientia* concerning celestial or terrestrial objects was to have knowledge of the **motions, shapes**, positions, and numbers of their parts. These mechanistic principles were the starting points that replaced Scholastic definitions. Descartes’ suppressed treatise on **physics**, *The World*, is an exercise in stating a new kind of *scientia* that, unlike its Scholastic competitors, applied uniformly to celestial and terrestrial objects. Its explanations invoked particles of matter that eluded sensory observation, and they exploited both arithmetical and geometrical quantities that were accessible only to an **intellect** able to free itself of the influence of sensory images (see **sensation**). So Cartesian explanations were open to both greater informativeness and greater generality than their predecessors. Furthermore, because they specialized in efficient causes, the explanations were in principle empowering, indicating what interventions might, at least in principle, produce observed effects. The forms of matter being relatively few, the new explanatory principles were less complex and *ad hoc* than traditional ones. Early modern *scientia* was in all these ways thought to be an advance on what preceded it. Early modern believers in *scientia*

disagreed not only over the nature of the **faculties** that gave access to the elemental explanatory principles but also about the reach of those faculties. In Descartes, the faculties are those of a finite **mind** in the same general class as the divine mind. Although embodiment and habitual reliance on the senses make it difficult for **human beings** to understand nature, and soften them up for accepting Aristotle's false sense-based physics, according to Descartes, we have latent in us a capacity for understanding independently of the senses that can acquaint us with **God** and with the principles of a *scientia* of nature.

Descartes' *Meditations* is an exercise in proving that *scientia* is possible for human beings even in the face of the most extreme skepticism about the powers of the human mind (see esp. AT VII 69, 71; CSM II 48, 49). *Scientia* is a special kind of knowledge. It is systematic knowledge of several related truths. So it contrasts with intuitions of single truths (see Kenny 1968, Tlumak 1978). Intuitions of single truths are knowledge, and so long as the attention is fixed, intuitions do not depend for their **certainty** on knowledge of God; but the attention naturally wanders, and the certainty of any one truth can be shaken by principles for calling into question whole classes of belief that Descartes introduces in the First Meditation (AT VII 18, CSM II 12). So intuition (or **clarity and distinctness**) needs to be backed up by something that can overturn those skeptical principles – namely, the certainty that God exists and is no deceiver (AT VII 62, CSM II 43). (This is the certainty that allows Descartes to arrive noncircularly at the *rule* that what is clear and distinct is true. See **Circle, Cartesian.**)

Scientia is knowledge that, once achieved, is not open to reconsideration through **doubt**, not even through the doubt that our minds might be defective. *Scientia* is unshakable vision of a system of truths because it includes *scientia* that God exists and would not have made the human mind go wrong about what is most evident to it. Being unshakable and true (AT VII 141, CSM II 101), human *scientia* resembles divine knowledge itself. God could not know now and then later lose his knowledge, for he wills all that is eternally true all at once and cannot fail to know what is therefore willed to be true for all time. In other words, God's knowledge is unshakable. Of course, the difference between human *scientia* and divine *scientia* is much greater than their resemblance. To the extent *we* have *scientia* it is by disciplining the attention, ordering its objects from simple to complex, and getting used to seeing totalities in the light of the simple. God's purchase on the objects of *scientia* is entirely different. For one thing, those objects are his creations, and he knows the natures of things by deciding what they will be, not by fixing his attention on them.

If God's immutability is both a model for human *scientia* and something we have to be aware of in order to acquire *scientia*, cannot Descartes claim with justice to have demonstrated that knowledge of God is essential to the knowledge of nature, just as the theologians would have wanted him to do, and just as he officially claims

he is trying to do when advertising the aims of his **metaphysics** to the doctors of the Sorbonne? The claim has some, but only some, plausibility in the context of the *Meditations*. But it is much weaker in connection with the *Discourse on Method* and its *Essays* and even weaker in *The World*.

Let us begin with the *Discourse*. Not only does Descartes pass very quickly over metaphysical truths in part 4, allowing the reader to infer from the brevity of his treatment that they do not matter much, but he also makes the very striking claim that the evident adequacy of the explanations of things in *Dioptrics* and the *Meteors* is on its *own* a proof of the principles of Cartesian natural science put forward in at least the two first *Essays*. This is how we might understand the following famous passage from the end of the *Discourse*.

Should anyone be shocked at first by some of the statements I make at the beginning of the *Dioptrics* and *Meteors* because I call them “suppositions” and do not seem to care about proving them, let him have the patience to read the whole book attentively, and I trust that he will be satisfied. For I take my reasonings to be so closely interconnected that just as the last are proved by the first, so the first are proved by the last, which are their effects. It must not be supposed that I am here committing the fallacy that the logicians call “arguing in a circle.” For as experience makes most of these effects quite certain, the causes from which I deduce them serve not so much to prove them as to explain them; indeed, quite to the contrary, it is the causes which are proved by the effects. (AT VI 76, CSM I 150)

In the same vein, there is this passage from the letter to **Mersenne** of May 27, 1638:

You ask if I regard what I have written about refraction as a demonstration. I think it is, in so far as one can be given in a field without a previous demonstration of the principles of physics by metaphysics – which is something I hope to do some day but which has not yet been done – and so far as it has ever been possible to demonstrate the solution to any problem of **mechanics**, or **optics**, or astronomy, or anything else which is not pure **geometry** or arithmetic. But to require me to give geometrical demonstrations on a topic that depends on physics is to ask me to do the impossible. And if you will not call anything demonstrations except geometers’ proofs, then you must say that Archimides never demonstrated anything in mechanics, or Vitellio in optics, or Ptolemy in astronomy. But of course nobody says this. In such matters people are satisfied if the authors’ assumptions are not obviously contrary to experience and if their discussion is coherent and free from logical error, even though their assumptions may not be strictly true.

I could demonstrate, for instance, that even the definition of the centre of gravity given by Archimedes is false, and that there is no such centre; and the other assumptions he makes elsewhere are not strictly true either ... but that is not a sufficient reason for rejecting the demonstrations. (AT II 141–42, CSMK 103)

Demonstrations can be successful even if they meet conditions far less exacting than those for metaphysical certainty. In other words, there can be science without *scientia*.

Now it might be thought that whatever concessions are made to science lacking in metaphysical certainty in the *Discourse* and *Essays*, these concessions would be withdrawn in the *Meditations*. But this is not quite what one finds. If anyone lacks metaphysical certainty, according to the principles in the *Meditations*, it is someone who is ignorant of God's existence, or someone who denies it: an atheist. But does the atheist necessarily lack knowledge or science, science in the sense of knowledge of something that results from demonstration? More than one set of objectors thought this was implausible (cf. AT VII 124, CSM II 89; AT VII 414, CSM II 279), and the *Replies* do not entirely disagree. Just as there can be a genuine demonstration that involves some incidental falsehood and that lacks metaphysical grounding, so there can be a kind of grasp of truth available even to those who think there is no God.

Descartes did not even deny that in some sense of "knowledge" the atheist could have knowledge; what he denied was that the atheist could have the preferred kind of knowledge called *scientia*:

The fact that an atheist can be "clearly aware that the three angles of a triangle are equal to two right angles" is something I do not dispute. But I maintain that this awareness of his is not true knowledge, since no act of awareness that can be rendered doubtful seems fit to be called knowledge. (AT VII 141, CSM II 101)

As for the kind of knowledge possessed by the atheist, it is easy to demonstrate that it is not immutable and certain. (AT VII 428, CSM II 289)

It is as if knowledge that was not immutable or incapable of being reconsidered critically could not *really* be knowledge. All we need interpret Descartes as saying is that the atheist is bound to lack *scientia*. We do not need to interpret him as saying that *scientia* is the only knowledge there is. There is also a lesser kind of knowledge.

This category of nonideal knowledge has an interesting range of application. Apart from the atheist, it extends to the scientifically open-minded believer who

does not know Descartes' metaphysics, including churchmen who were instructed in optics and meteorology by the *Essays* and would have been instructed by *The World* in physics, had it been published. More importantly, it applies to Descartes himself before he discovered his proofs of metaphysical truths in 1630. The fact that Descartes himself had only imperfect knowledge before 1630 may show that the scientific discoveries he made before 1630 were not *scientia* in the sense of the *Meditations*. But surely they counted as science. The fact that these discoveries might have been rendered doubtful or disputed by critics, let alone by methodical doubt, does not seem to make them count any less as science, just as the fact that the demonstrations of Archimedes might be corrected does not show that they were not demonstrations. On the contrary, it is the honorific sense of "science" (science in the sense of *scientia*) and the honorific sense of "demonstration" (demonstration in the sense of geometrical demonstration) that seems unduly narrow or stipulative – even, at times, from Descartes' own point of view as scientist. Up to a point, this narrowness is the direct result of the grounding of Descartes' science in the doctrine of God's nature.

The point can be made in a different way. Before 1630 – before science was metaphysically grounded – Descartes may be said to have developed a merely provisional philosophy of science broadly analogous to the *morale par provision* (provisional moral code) of the *Discourse*. The provisional philosophy of science is permissive about what to include as science. It includes the imperfect demonstrations of Archimedes and Ptolemy. The official or strict philosophy of science is the theologically correct one in which *scientia* is the human counterpart of divine knowledge. It excludes discoveries that can be rendered doubtful or that contain elements of falsehood and probably only contains the Cartesian sciences. The more restrictive philosophy of science is not necessarily a better or even more authentically Cartesian philosophy of science. Unshakable certainty in physics and **mathematics** is intelligible as an ideal, of course, especially if divine *scientia* sets the pattern for human cognitive perfection. But openness to the opinion of others at least as intent upon the truth as oneself is also consistent with a program of enlarging knowledge. In the *Discourse*, Descartes seems to have been keen to display such open-mindedness, inviting objections from his readers and promising to respond to them. The open-mindedness seems to have been more than a pose, as Descartes does seem to have seen the value of the work of his contemporaries – **Harvey**, for example, or **Galileo**, even **Hobbes** when it came to civil science. The emphasis on unshakable certainty, privately arrived at, seems to have started with the composition of the *Meditations*.

See also Certainty; Circle, Cartesian; Clarity and Distinctness; Deduction; Doubt; God; Truth

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TOM SORELL

LA FORGE, LOUIS DE (1632–1666)

La Forge was born at La Flèche, where his father was a physician. He also became a physician, but nothing is known about his studies. He spent his life between La Flèche (the town where Descartes had studied at the **Jesuit** college) and Saumur (in the Loire Valley), where he died in 1666. Around 1650, he was known as a defender of Descartes' **physics**. When **Clerselier** looked for someone to draw the illustrations in order to publish Descartes' *Treatise on Man* (a part of *The World*, published posthumously), as mentioned in the second volume of *Descartes' Letters*, La Forge offered to work on these illustrations. La Forge sent not only illustrations but also *Remarques* to clarify the ambiguities of the Cartesian text while claiming to remain faithful to Descartes.

La Forge's *Remarks* are footnotes and they often refer to his own forthcoming *Traité de l'esprit de l'homme* (*Treatise on the Human Mind*). So, these *Remarks* are not complete, the longest ones dealing with the structure and functions of the brain and with the "**animal spirits**," important topics in Descartes' text, while others comment on the mechanical **explanations** given by Descartes. Some of them defend Descartes against the "difficulties" raised by the physician Bartholin (Bartolin) in his *Anatomia Reformata*. As to the illustrations of the *Treatise on Man*, La Forge explains that he felt "committed less to representing things according to Nature than to rendering intelligible" what Descartes had to say. For instance, the **pineal gland** is figured much bigger than it is (see **pineal gland**, Figure 27).

The *Treatise on Man*, with *Remarks by Louis de La Forge* was published in Paris in April 1664, with a preface by Clerselier quoting **Saint Augustine** (*De Trinitate*, X, cap. X) and, at the end, a French translation of Schuyt's preface to the Latin translation of the *Treatise on Man* published in Leiden in 1662 (made from a copy of the French original), dealing with the "bêtes-machines" (see **animal**) and referring to Saint Augustine (*De libero arbitrio*, cap. VIII).

La Forge's *Traité de l'esprit de l'homme* was issued in Paris in 1665 with the date of 1666. In the *Préface*, La Forge explains that the Cartesian conception of the soul is not different from the doctrine of Saint Augustine, who was not quoted in the *Remarks*. Augustine is quoted only twice in the *Traité* (the *Confessions*, XIII, cap. XXXVIII, in ch. XI, and the Epistle 57 in ch. XII), which includes references to some letters of Descartes to **Mesland**, **Elizabeth**, **Chanut**, and **Queen Christina**, already published by Clerselier in 1657 and 1659, and also to **Gassendi**, **Regius**, and **Clauberg**. The references to Augustine were used in order to minimize the importance of the condemnations of Descartes' writings by the Catholics at Louvain in 1662, then by Rome in 1663, when Descartes' works were put on the Index of Prohibited Books. They lead to a "Cartesian spiritualism" (cf. Gouhier 1978). La Forge emphasizes the importance of the expression "à l'occasion de," which foreshadows the doctrine of

occasionalism in **Malebranche** and other Cartesians, according to which God is the only genuine **cause**. He also goes further than Descartes on the doctrine of divine conservation (see **concurrency versus conservation, divine**). With La Forge, and in reference to Descartes, the French words *sensation* and *conscience* became widespread.

See also Anatomy and Physiology; Animal Spirits; Augustine, Aurelius; Body; Cartesianism; Cause; Pineal Gland; *Treatise on Man*

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ANNIE BITBOL-HESPÉRIÈS

LA GRANGE, JEAN-BAPTISTE DE (CA. 1641 – AFTER 1680)

Few data are available on La Grange's life, except that he entered the Oratory in 1660 and left in 1680 to become a parish priest in Chartres. During these two decades, he taught **philosophy** at Montbrison and Le Mans and theology at Troyes.

La Grange is the author of a two-volume treatise *The Principles of Philosophy against the New Philosophers*. Although these "new philosophers" include **Pierre**

Gassendi and Emmanuel Maignan, La Grange's main target is **Cartesianism**. The title polemically alludes to Descartes' own *Principles of Philosophy*. La Grange also aims at Descartes' followers, **Rohault** mainly, and, unnamed, **Malebranche**, whose theory of the "vision in God" is denounced (1675–79, 1:78).

La Grange's preface refers to Louis XIV's 1671 decree, which banned the teaching of Cartesianism on the ground that it jeopardizes the traditional account of "the mysteries of the faith." Similarly, La Grange's first and main reproach is that the principles of Cartesianism are incompatible with a number of revealed truths. According to him, theological dogmas provide a litmus test for philosophical principles. Even if these principles appear to be evident and certain, they cannot be but false if they generate conclusions that are opposed to revealed truths.

In particular, contrary to Descartes' claim, it is impossible to account for **transubstantiation** without the tools of "ordinary philosophy," such as accidental forms. As a consequence, La Grange undertakes to rehabilitate real qualities, that is, entities which are ontologically different from the **substance** in which they inhere, instead of being just **modes** of that substance (see **quality**, **real**). Thence, La Grange tries to prove that accidents are not reducible to their substances. This applies to qualities residing in the soul, such as **virtue** or **knowledge** as well as to physical properties. The latter are not reducible to relations between parts of matter, that is, to figure and **motion**, as the Cartesians want it. Thus, La Grange directly challenges Cartesian natural philosophy and contends that no serious theory can do away with entities such as **quantity** (which entails that **extension** is not merely the **essence** of bodies), heat, sound, and colors. In the course of his refutation, La Grange also criticizes Cartesian theses on motion, place and void, the infinity and the uniqueness of the universe, and the mechanistic explanatory ideal (systematically assimilated to the dangerous Epicurean atomism); and he defends the immobility of the earth (see **earth**, **motion of the**). La Grange's treatise was rather successful and several times republished (1681 to 1684).

See also Atom; Body; Cartesianism; Extension; Form, Substantial; Gassendi, Pierre; Malebranche, Nicolas; Mode; Motion; Quality, Real; Rohault, Jacques; Substance; Transubstantiation; Vortex

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JEAN-LUC SOLÈRE

LAMY, BERNARD (1640–1715)

Born June 15 in Le Mans, Lamy entered the **Oratorian** *maison d'Institution* in Paris at age eighteen. After attending the Oratorian seminary in Saumur (1659–61), he taught at the Collège de César at Vendôme (1661–63), the *collèges* at Juilly (1663–68) and at Le Mans. He left there in 1669 for further study, after which he taught **philosophy** at Saumur (1671–73) and then Angers (1673–75). In 1675 he was expelled from the faculty at Angers for teaching **Cartesianism**. The report of his censure shows it to be imposed for holding, among other Cartesian ideas, that the principal **attribute** of **body** is **extension** (AT VIIIA 42–43, CSM I 224), that infants think in utero (AT III 424, CSMK 190; AT IV 605, CSMK 307–8), and that **God** is both the primary **cause** of **motion** and preserver of the quantity of motion in the world (AT VIIIA 61–62, CSM I 240). Two years after his expulsion, Lamy was awarded a chair at the seminary in Grenoble, where he remained for several years. Following three years in Paris, Lamy was sent in 1689 to Rouen. He died there on January 29, 1715. Lamy was the author of many books on a wide array of subjects, including **mathematics**, rhetoric, and theology. His most important philosophical work is *Entretiens sur les sciences* (1683). It is first a study of pedagogy, but Lamy's view that the **mind** contains innate **ideas** (and that it is the teacher's role to draw these out) is very Cartesian, as is his claim that **reason** can discover truths that are beyond the powers of **sensation** to reach. Lamy praises Descartes' mechanical understanding of the natural order (including the human body), and he argues that genuine scientific **explanations** must be in mechanical terms. He also accepts the view that the *cogito* provides us with **certainty**.

See also Attribute, Body, Certainty, *Cogito Ergo Sum*, Extension, God, Idea, Mind, Motion, Oratorian, Reason, Sensation

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FRED ABLONDI

LAMY, FRANÇOIS (1636–1711)

Born at Montireau in the region of Beauce, Lamy was a soldier before joining the Maurists, a congregation of French Benedictines, in 1658. While in Paris he studied **mathematics** with the Cartesian **Jacques Rohault** (1618–72) and subsequently became one of the first of the Maurists to teach **Cartesianism**. His published works display the strong influence of **Nicolas Malebranche** (1638–1715). In particular, Lamy holds the two positions that are most often associated with Malebranche, namely, that there is a universal, uncreated **Reason** to which we have access via a vision in **God**, and that God is the sole efficient **cause** in the world. His works include *Le nouvel athéisme renversé, ou Réfutation du système de Spinoza* (1696), *Lettres philosophiques sur divers sujets importants* (1703), and *Les premiers élémens des sciences* (1706). But his magnum opus is his five-volume *De la connoissance de soi-mesme* (1694–98). While many of the positions he defends there are taken from Malebranche, an exception is his main argument for **occasionalism**, which is one not found in the other major French occasionalists. It is based on the need for God's causal power to account for what appears to be interaction between the **mind** and **body**, understood in Cartesian terms as an immaterial thinking thing and an unthinking extended thing, respectively, given the fact that they are radically distinct **substances**. This argument led to a dispute with **Gottfried Leibniz** (1646–1716), who felt that his own doctrine of pre-established harmony was a better way to explain such "interaction." The second edition of *De la connoissance de soi-mesme* (1699, in six volumes) contains Lamy's response to Leibniz, in which he argues that preestablished harmony is not compatible with

human freedom (see **free will**). Lamy also engaged in disputes on various philosophical and theological matters with Bossuet, Nicole, **Arnauld**, Fontenelle, **Régis**, and even Malebranche. He died April 11, 1711, at the Abbey of Saint-Denis.

See also Body; Cause; God; Leibniz, Gottfried Wilhelm; Malebranche, Nicolas; Mind; Reason; Rohault, Jacques

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FRED ABLONDI

LANGUAGE

Descartes' epistemology assigns a central role to mental contents or **ideas**. Language [*loquela*, *langue*] plays a secondary and auxiliary role – that is, for the storage and communication of previously constituted **thoughts**. From this perspective, the possession of "ideas" is seen as independent of, and prior to, their linguistic expression. Moreover, the direct inspection of ideas provides the criterion of meaning for a correct usage of words.

1. IDEAS AND LANGUAGE

As a philosophical innovator, Descartes is bound to make use of a preexisting vocabulary – either ordinary or philosophical – while providing it with new meanings. Thus, in the *Second Meditation*, after gradually discovering the true notion of **mind**, he finally applies some common and traditional terms to it, but he is eager to stress that now they are given a novel and correct meaning: "I am ... in the strict sense only a thing that thinks; that is, I am a mind, or intelligence, or **intellect**, or **reason**, words whose meaning I have been ignorant of until now" (AT VII 27, CSM II 18). Conversely, a few lines below he warns us that our language often perpetuates confused ways of thinking: "Although I am thinking about these matters within myself, silently and without speaking, nonetheless the actual words bring me up short, and I am almost tricked by ordinary ways of talking [*decipior ab ipso usu loquendi*]" (AT VII

31–32, CSM II 21). He adds that “one who wants to achieve **knowledge** above the ordinary level should feel ashamed at having taken ordinary ways of talking as a basis for **doubt**” (AT VII 32, CSM II 21). Actually, ordinary language incorporates in its meanings the confused notions originating from infancy. Moreover, it can mask our lack of understanding. The warning against the abuses of language is systematically developed in *Principles* I.74:

Because of the use of the language we tie all of our concepts to the words used to express them [*loquela*], and when we store the concepts in our **memory** we always simultaneously store the corresponding words. Later on we find the words easier to recall than the things; and because of this it is very seldom that our concept of a thing is so distinct that we can separate it totally from our concept of the words involved. The thoughts of almost all people are more concerned with words than with things; and as a result people very often give their assent to words they do not understand. (AT VIIIA 37–38, CSM I 220)

To sum up: on the positive side, only philosophical analysis can isolate the correct meanings to be attached to words; on the critical side, constant attention is required to purge our ideas of the misleading veil of language, which can mask philosophical mistakes or even the absence of any idea.

So far, Descartes insists on the analysis of ideas as a necessary condition for meaningful usage of language. On occasion, however, he argues for the existence of ideas by relying on our ability to grasp the meaning of words. For example, to an empirically minded objector who denies having an idea of **God**, he replies that “we cannot express anything by our words, when we understand what we say, without its being certain that we have in us the idea of the thing which is signified by our words” (AT III 393, CSMK 185). In this case, the meaningfulness of our linguistic usage is assumed and taken as a sufficient condition to be assured of our possession of the corresponding ideas.

Descartes endorses a conventionalist view of words. Conventionalism, or the view that the connection between ideas and words is totally arbitrary, complements his apparent view of the secondary role of language; it also provides a powerful model for several important aspects of his philosophy.

2. A UNIVERSAL LANGUAGE?

The concept of an Adamic language, thought to contain the seeds of a primitive wisdom, was widespread in the culture of the time. Descartes’ strong adhesion to conventionalism makes him distrustful of any such notion. Language is created by use.

He is also very cautious about the projects for an artificial universal language. In his letter of November 1629 (AT I 76–82, CSMK 10–13), concerning a kindred project submitted to his **judgment** by **Mersenne**, he distinguishes the lexical and grammatical sides of the project: “There are only two things to learn in any language: the meaning of the words and the grammar” (AT I 76, CSMK 10). As concerns the latter, a simplified regular grammar could be in principle easily developed, by eliminating the irregularities due to the “corruption of the usage,” which is proper to natural languages; it would be not easily applied, however, because the irregularities chiefly come from phonetic constraints, varying when passing from one language to another. Descartes seems more concerned with the lexical side, with the possibility of fixing a basic lexicon. Still, in the project he is considering this would amount to the rather trivial task of the construction of some tables for translation. Perhaps ideograms could be assigned as written symbols for these basic lexical elements, but this also would be not very significant in Descartes’ view.

This side of the project would be far more relevant, however, if it were to involve the discovery of a true alphabet of human thoughts, along with its elements and their rules of combination: “I believe ... that it would be possible to devise a further system to enable one to make up the primitive words and their symbols in such a language so that it could be taught very quickly. Order is what is needed: all the thoughts which can come into the human mind must be arranged in an order like the natural order of the numbers” (AT I 81, CSMK 12). Still, Descartes is rather skeptical about its feasibility; most of all, the constitution of such a language would, in any event, be posterior to the discovery of the “true **philosophy**” – in keeping with his general belief in the secondary role of language with respect to the analysis of ideas. Two aspects remain foreign to his approach, while being present, for example, in **Leibniz**’s conception of the same project: the idea of a constitutive role of signs in thought; and the attention to purely syntactical manipulation, in view of a “mechanical” implementation of thought.

3. LANGUAGE AS A TEST FOR THOUGHT

In the first-person itinerary of metaphysical **meditation**, the meditator has direct access to his inner life. Language is only a by-product of thought, sometimes even an obstacle to be removed in order to free himself from the sediment of confused meanings that settled there. This role of language in Descartes’ metaphysical approach seems to be radically overturned in other texts, where a “scientific” approach to the study of man is pursued. Thus, in *Discourse* V, language is presented as the main sign of the presence of thought and of a mind that thinks. There is no contradiction here: thought preserves its ontological and logical priority, but from a heuristic point of view one of its consequences – namely, language – assumes priority.

We are no longer moving from the point of view of a meditator who, at least up to a certain point, ignores the existence of external reality, but from the opposite fiction of a man reduced to his **body**, that is, to an **automaton**. Or equivalently, we are faced with the problem of recognizing “from the outside” the presence of a mind – that is to say, of deciding whether the other physical beings we encounter are endowed with a mind to which we do not have direct access: “If any such **machines** bore a resemblance to our bodies and imitated our actions as closely as possible for all practical purposes, we should still have two very certain means of recognizing they were not real men. The first is that they could never use words, or put together other signs, as we do in order to declare our thoughts to others” (AT VI 56, CSM I 140).

According to Descartes, linguistic competence is the fundamental sign of the presence of a mind – the other sign being the infinite versatility of reason as a universal tool. Upon closer inspection, the two “signs” overlap, at least partially, because flexibility is the crucial aspect of language in Descartes’ test: that is to say, the ability to use words appropriately to react to new and unpredictable situations. We would speak of a stimulus-free response, something that cannot be captured by mechanical devices and procedures, hence what can make us sure that we are not faced with automata.

Animals fail the test. This result turns contrary to a widespread literature of the age (whose main sources were Montaigne and other skeptically minded authors), which attributed “reason,” and in many cases a true language, to animals. In Descartes’ view, the denial of linguistic competence to beasts and the counterintuitive thesis that regards them as mere “machines” stand or fall together. According to him, linguistic competence indicates the possession or absence of rationality and does not allow for degrees. Even the most perfect animals do not show this competence; by way of contrast, the less evolved and even defective men do (AT VI 57–58, CSM I 140–41). Animals, even if they are endowed with similar physical abilities for the articulation of sounds, do not make use of a language, whereas men who are prevented from making use of the organs of speech create alternative systems of signs that must be recognized as true languages.

In a later letter to **Newcastle** (AT IV 573–75, CSMK 302–4), Descartes makes further explicit some qualifying features of a language, taken in its proper and relevant sense: to be constituted from signs that do have reference; and to be distinguished from the external signs of “**passions**.” With respect to the former, Descartes aims at excluding from the scope of “language” the mere production of strings of sounds, by which some animals, like parrots or other “speaking” birds, can mimic human speech. The salient feature of a language and its usage turns out to be the intentional aspect of semantic competence, that is to say, the speaker’s ability to make use of *interpreted* signs.

With respect to the latter feature, Descartes excludes the expressions of psychophysical affections. Such expressions could be accounted for mechanically and

also take place as a mere consequence of physical **motions**, without postulating any understanding or even any corresponding subjective state of feeling. Cries, for example, are natural signs to be sharply distinguished from the signs that constitute a language. Also, from this point of view, conventionality seems to be an important distinguishing feature of a true language.

Whereas Descartes' metaphysical approach has been criticized for its devaluation of language, his linguistic test for consciousness has attracted – at least since Noam Chomsky's seminal reflection on the so-called Cartesian linguistics – vigorous attention as an antecedent of the central role of language in the present-day philosophy of mind.

It is impossible here to enter the debate concerning Descartes' alleged anticipation of some themes of present-day linguistic thought, particularly in its Chomskian variety. We must limit ourselves to point out some differences in the approach to similar themes, leaving aside the general issue of innateness and focusing on some specifically linguistic aspects. As we have seen, Descartes does not seem particularly interested in the concept of a universal grammar, underneath the surface of particular historical grammars. Admittedly, this aspect might be implicitly taken for granted in his considerations to Mersenne (see letter quoted earlier in this entry); and it will become most relevant for some of his followers (see the Port-Royal *Grammaire*). In his interpretation of the *Discourse* test, then, the emphasis on linguistic creativity and on the capacity to provide pertinent answers to unpredictable solicitations, is not centered on the syntactical aspect. Descartes intends rather to stress an irreducible semantic competence. Even if God's omnipotence were to produce a machine able to perfectly mimic human linguistic behavior by the disposition of its organs – thus passing Descartes' test – nevertheless from his point of view, this machine, not being able to interpret the produced words as "signs," would therefore not make use of language. But even in this case the production of a system of signs would presuppose an intelligence – be it God's, rather than man's.

4. LANGUAGE AS A METAPHYSICAL PARADIGM

Descartes uses the conventional nature of language as a powerful paradigm for wide-ranging epistemological and metaphysical considerations. For example, in *The World* (AT XI 4, CSM I 81), *Dioptrics* (AT VI 112, CSM I 165), and *Principles* IV.197 (AT VIII 320–21, CSM I 284), he relies on the model of the word-meaning relationship as a typical arbitrary or conventional connection, where no similarity is presupposed. His aim is to induce the reader, by way of **analogy**, to accept the dissimilarity between our **sensations** and their physical **causes**. That is to say: the linguistic paradigm is used by Descartes to destroy the commonsense and Scholastic "iconic" view of sense **perception**. The human institution of language is the model for the divine "institution of

nature” – that is, for the way in which our cognitive apparatus “codifies” the mechanical stimuli.

More generally, the model of language might be used to illustrate the phenomena of mind-body interactions, which Descartes’ readers have found so difficult to understand (see **human being**). Descartes suggests this generalization in a letter to **Chanut**:

There is no reason to be surprised that certain motions of the **heart** should be naturally connected ... with certain thoughts, which they in no way resemble.... In the same way when we learn a language, we connect the letters or pronunciation of certain words, which are material things, with their meanings, which are thoughts, so that when we later hear the same words, we conceive the same things, and when we conceive the same things, we remember the same words. (AT IV 604, CSMK 307)

The comparison – later made explicit and articulated in **Cordemoy’s** *Discourse* – inverts the explanatory direction of a traditional analogy, where the matter-form pair was used to understand the meaning-sign relationship. According to Descartes’ suggestion, language provides the paradigm necessary to conceive of a relationship between body and mind, which, unlike the hylomorphic model, holds between two completely heterogeneous things (see **form, substantial**).

See also Animal, Automaton, Idea, Machine, Mind, Reason, Thought

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STEFANO DI BELLA

LAW OF NATURE

Descartes was among the first modern scientists to make the search for laws of nature central to his scientific work, and apparently the first philosopher to think deeply about the logical and metaphysical status of these laws, developing a theory that provides a significant alternative to the Humean approach that long dominated Anglophone thinking on this topic (Milton 1998, 686).

Writing to **Mersenne** in November 1629, Descartes announces an ambitious project: he has resolved to explain, not just one phenomenon, but "all the phenomena of nature, that is, the whole of **physics**" (AT I 70, CSMK 7). In *The World*, begun early in the 1630s, but never finished, we see the beginnings of that project. Descartes invites us to imagine a new world, somewhere in "the imaginary spaces," where **God** created so much matter that in whatever direction our imagination extends, it finds no empty **place** (AT XI 31–32, CSM I 90). In this matter are three kinds of elementary particles, distinguished only by size, **shape**, and **motion** (AT XI 34, CSM I 94) (see **element**). The phenomenal properties of macroscopic objects (heat, **light**, hardness, fluidity, etc.) are to be explained by the properties of their constituent particles, and especially by motion, according to the laws of nature.

This early mechanist program posits three fundamental laws:

1. Unless an encounter with other bodies **causes** a change, each part of matter continues in the same state: size, shape, and position (if at rest), or motion (if in motion).
2. When one **body** collides with another, it cannot give it any motion unless it loses as much as the other body gains; if it takes motion from the other body, it must gain as much motion as it takes away.
3. If a body is in motion, even if it usually moves in a curved line, each of its parts will tend to move in a straight line, departing from that path only as constrained by other bodies. ("Usually" is odd. Since Descartes rejects any

vacuum, he holds that all actual motion must be in a closed curve.) (AT XI 36–48, CSM I 92–98)

The first law, when combined with the third, is often described as a version of the principle of **inertia** (for cautions about using this language, see Garber 1992, ch. 7).

Descartes claims that even if we assumed that God initially created a chaotic world, it would be possible to explain, given these laws (and these assumptions about the nature of the particles), how they would have sorted themselves out into an orderly, “very perfect” world, displaying the properties we find in the actual world (AT XI 34–35, CSM I 91). Describing his unpublished work later, in the *Discourse on Method* (1637), Descartes insists on its hypothetical character. Probably God did not create a chaos but made a world that was “just as it should be” (in the *Principles* Descartes will say that there is *no doubt* that the world was created with all its perfection [AT VIIIA 99–100, CSM I 256]). But we will understand our world better if we see how it would have developed gradually from a less auspicious beginning (AT VI 45, CSM I 133–34).

The hypothetical nature of Descartes’ early **cosmology** looks like a protective device, designed to avoid conflict with scripture. When he learned that the church had condemned **Galileo** for writing a dialogue whose most persuasive participant argued for Copernicanism, he apparently decided that it would be unwise to publish a work whose cosmology was Copernican, even if he presented that cosmology only hypothetically (see AT I 270–72, 281–82, 285–88; CSMK 40–44). Some would argue that living in a Protestant country, Descartes had nothing to fear from the church. But to be openly Copernican would have cost him an opportunity he greatly desired: to have his philosophy replace Aristotelianism in Catholic schools. So he abandoned trying to give a complete science until he had devised a way of explaining his theories that did not picture the earth as moving.

Meanwhile he presented some of his ideas in a way that did not require claims about the whole physical world. To his *Discourse on Method* he appended a treatise on **optics** where he derived the laws of reflection and refraction from the hypothesis that light is an inclination to movement, obeying the same laws motion does. A companion treatise on meteorology offered explanations of phenomena involving these laws, such as parhelia and **rainbows**. These works reveal a Descartes for whom the scientific **explanation** of a phenomenon requires showing that it can be deduced from the laws of nature, supplemented by hypotheses about the nature of the objects under consideration.

In the *Principles of Philosophy* (1644), Descartes returns to the project that fear of theological opposition had caused him to defer. He develops a theory of motion according to which, strictly speaking, the earth does not move (AT VIIIA 90, CSM I 252). And he revises his laws of motion. The first and third laws remain roughly the same, though the third now comes second, and the first is qualified in new ways. Now it reads:

Each thing, *insofar as it is simple and undivided*, always remains, *as far as is in its power*, in the same state and is never changed except by external causes. (AT VIII A 62, CSM I 240–41; emphasis added)

In principle, this would apply to minds as well as to simple bodies. But Descartes applies it only to bodies. The second italicized phrase translates *quantum in se est*, language helpfully analyzed in Cohen 1964, which shows that it was often understood as a reference to the internal power or nature of a thing. The most significant difference occurs in the second law (third in the new order):

If a moving body encountering another has less force to continue in a straight line than the other has to resist it, then it's deflected in a different direction; retaining its motion, it loses only the determination of its motion; if it has a greater [force], it moves the other body with it, giving it as much of its motion as it loses. (AT VIII A 65, CSM I 242)

Here Descartes introduces a concept he had not used in stating his laws in *The World* (though he did use it in commenting on the first law), the concept of force: a force for continuing in rectilinear (or straight-line) motion, and a force for resisting change of state (see **force and determination; inertia**).

This is surprising because Descartes claimed to assume as fundamental properties of bodies only the perfectly intelligible properties postulated by **geometry**. All others were supposed to be derived from those by the laws of nature (AT XI 33–34, CSM I 91). Force seems to be neither a geometrical property nor derivable from geometrical properties by the laws of nature. Descartes says this force consists in the tendency each thing has to remain, as far as it can, in its state, as required by the first law, and that its measure is the thing's quantity of motion, the product of its size and speed (AT VIII A 66, CSM I 243). This may be plausible for moving bodies. But bodies at rest have no quantity of motion, even though they evidently have a force for resisting a change in their state.

After stating these laws, Descartes undertakes to derive seven rules applying them to special cases: saying what will happen, for example, when two bodies, equal in size and speed, but moving in opposite directions, collide. From there he goes on to develop accounts of the motions of the heavenly bodies, the nature of light, of the earth, of **gravity**, of the tides, of fire, and so on. These more specific collision laws were the focus of much discussion later in the seventeenth century, challenged, for example, by both **Spinoza** and **Huygens**.

When the Abbé **Picot** translated the *Principles* into French (1647), Descartes wrote a letter to serve as a preface to the new edition, introducing a striking metaphor to explain the relation of the various sciences to one another: "The whole of **philosophy** is like a tree, whose roots are **metaphysics**, whose trunk is physics, and

whose branches are all the other sciences,” including **medicine**, **mechanics**, and morals (AT IXB 14, CSM I 186). This articulates the idea of the unity of the sciences but in a form that makes the most fundamental science not physics but metaphysics.

Descartes had attempted to derive his basic physical laws from metaphysics as early as *The World* (AT XI 37–38, 43–45; CSM I 93, 96). In the *Principles*, he develops that argument more thoroughly. Metaphysics includes a **definition** of God as a supremely perfect being (AT VIIIA 10, CSM I 197); this definition entails that God is immutable (AT VIIIA 61, CSM I 240); immutability in turn entails that God acts in the world in a constant manner, via general principles, “laws of nature,” which are the same at all times and places. Descartes calls God “the primary ... [and] general cause” of all the motions in the world, and the laws of nature their “secondary and particular cause” (ibid.).

Commentators have sometimes been reluctant to take Descartes at his word when he says that the laws are secondary causes. Hattab (2000, 108), though more inclined to do so than others, has been apologetic about it, calling the thought that laws of nature could function as efficient causes “mind-boggling” and expressing surprise that Descartes might characterize them as “efficacious”: “From our contemporary perspective we assume that laws of nature must be propositions describing the regularities with which bodies interact. Thus we automatically rule out that they could literally play the role of secondary causes for Descartes” (cf. Hattab 2007, 76). Schmaltz (2008, 115n) has rejected this reading of the text, arguing that regarding the laws as causally efficacious leads to occasionalism, and that we should rather treat bodies themselves as secondary causes.

Clearly, it was not Hattab’s intent to make Descartes an occasionalist, and it is difficult to see why her account should be called a “reading” of the text, as opposed to a straightforward rendering of what it says. What this shows, presumably, is that Descartes did not have a Humean view of the nature of laws, and probably that he also had a different conception of causation than Hume had. Clatterbaugh (1995, 199) has suggested that Descartes assumed “a conception of cause that treats *any proposition that occurs as a premise in a scientific explanation* as a cause” (emphasis in original). This may not work as a general account of causation in Descartes. It would need to be modified to allow God’s **essence** to be the cause of his **existence**, and it might be problematic in cases where the human will causes bodily motion. But some version of Clatterbaugh’s suggestion may be correct. Descartes had characterized the laws of nature as causes as early as *The World* (AT XI 34, CSM I 91).

Hattab recognizes that Descartes’ treatment of his laws as secondary causes, mediating between God and finite things, helps him solve a metaphysical problem: How can the changes in a constantly changing world result from the will of a being whose will cannot change (AT XI 37, CSM I 92–93)? After the creation of a material world whose parts are either at rest or in motion to one degree or another, God needs only to sustain this world in existence by his ordinary concurrence for there to be change (see **concurrence versus conservation, divine**). The laws,

operating on these variously moving parts, will do the rest. (The most thorough treatment yet of Descartes' doctrine of concurrence takes "ordinary concurrence" to mean God's continued, nonmiraculous conservation of matter in motion, an act that is not distinct from his initial act of creation. Schmaltz [2008, 8, 92, 100–3] argues that God's conservation should not be viewed as a continual re-creation of bodies in different places but as a continuation of the initial act of creation.)

Descartes also holds that it follows from God's nature not merely that events in the physical world will happen according to uniform laws but that those laws will have the content they do. It is easy to see why he might think this of the laws of persistence (the first two laws in the *Principles*). It is not obvious that the third law follows. Both in *The World* and in the *Principles*, Descartes embraces a conservation principle alleged to explain this: by his concurrence God preserves the same total quantity of motion and rest in each succeeding state of the world as he had put in it in the beginning (AT XI 43, CSM I 96; AT VIIIA 61, CSM I 240). But there are many ways that general principle could be true without each individual case of collision conforming to the third law (see Garber 1992, 201–2).

Descartes' attempt to deduce his laws from metaphysical principles makes his science seem quite *a priori*. Perhaps it is not as *a priori* as it seems. One thing that introduces an empirical element into Descartes' philosophy of science is his recognition that to explain particular phenomena we need to devise hypotheses about the constitution of the things underlying those phenomena, hypotheses that must be tested experimentally (see AT VI 64–65, CSM I 144). But that is a topic for another entry (see **experiment**). Here we concentrate on the implications of Descartes' project for the modal status of the laws. Suppose the laws do follow from God's nature. Statements about God's nature must be necessary if any are. (Some have wrongly interpreted Descartes' doctrine of the creation of the **eternal truths** as entailing that all are contingent [see Frankfurt 1977, rebutted in Curley 1984].) But propositions that follow from necessary truths alone must themselves be necessary. So Descartes should think that the laws of nature are necessary.

The evidence is that he did. In the *Discourse*, summarizing the contents of his unpublished *The World*, Descartes writes that in it

I showed what the laws of nature were, and without basing my arguments on any principle other than the infinite perfections of God, I tried to demonstrate all those laws about which we could have any doubt, and to show that they're such that, even if God created many worlds, there could not be any in which they failed to be observed. (AT VI 43, CSM I 132)

There is a similar statement in *The World*: "If God had created several worlds, [these eternal truths] would be as true in all of them as they are in this world" (AT XI 47,

CSM I 97). (Some may argue that this statement applies only to mathematical truths. It is unclear that Descartes made any modal distinction between laws of nature and mathematical truths. But the passage in the *Discourse* is unambiguously about physical laws.) If the laws of nature must be observed in any world God might have created, then they must be observed in all possible worlds – they are, as we would say, necessary truths.

Descartes has other reasons for embracing this position, independently of their deducibility from truths about God's nature. His hypothetical procedure in *The World* requires him to say that his laws of nature hold in *a world God might have created* somewhere in imaginary space. Since the initial stipulation of this world says nothing more about it than that God might have created it, the laws must hold in *any* world God might have created. They are not just generalizations about what we find in the actual world. Moreover, even after Descartes drops talk of a hypothetical world, his "inertial" laws make a claim about how bodies *would* act in the absence of interference from other bodies. But since he thinks the world must be a **plenum**, external interference is never absent.

If the laws of nature make claims about how things would behave in situations never actually realized, then anyone inclined toward a correspondence theory of **truth** – as Descartes seems to have been (see AT II 597, CSMK 139) – may wonder what it might mean to say they are true. Perhaps this is why Descartes was attracted by the comparison between the eternal truths and those a king might lay down for his kingdom (AT I 145, CSMK 23). One thing that makes this comparison inviting, arguably, is the fact the validity of the king's law does not depend on the existence of lawbreakers (Curley 1984). If the king's law against theft is successful in preventing it, so that there are no thieves, it is nonetheless true that anyone guilty of theft will be subject to certain penalties.

In the twentieth century, the counterfactual force of laws of nature was an important consideration motivating necessitarian alternatives to the Humean account of laws of nature (see, e.g., Hooker 1998). The twentieth-century discussions do not seem to have been aware of Descartes' anticipation of this way of thinking about laws. In the seventeenth century, Descartes had at least one notable follower in this view. Though **Spinoza** rejected Descartes' comparison of God's power with the power of kings, he accepted the ideas that scientific explanation proceeds by subsumption under the laws of nature and that those laws are necessary truths (see his *Theological-Political Treatise*, chs. 4, 6). From these ideas, combined with a more general determinism about the physical world, he drew a conclusion Descartes would have hated: miracles are impossible.

See also Body; Cause; Concurrence versus Conservation, Divine; Eternal Truth; Experiment; Explanation; Force and Determination; God; Inertia; Motion; Physics; Plenum; Truth; Vacuum

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EDWIN CURLEY

LE BOSSU, RENÉ (1631–1680)

A canon and librarian of the abbey of Sainte-Geneviève in Paris, Le Bossu is the author of a systematic comparison of Aristotelian and Cartesian **physics** (the latter often being actually **Jacques Rohault's** version). Surprisingly, Le Bossu believes that they can be reconciled. How can such a feat be achieved? Le Bossu thinks that the difference between Aristotle and Descartes is above all a matter of presentation. Descartes (in the *Principles*) systematically expounds a full-fledged science, which, Le Bossu (1674, 314) contends, Aristotle possessed but did not want to divulge! Thus, Descartes dismisses the testimony of the senses and starts with the most general principles, such as **motion**, from which he deduces the properties of particular **bodies** (Le Bossu 1674, 203–4). On the contrary, Aristotle starts with immediate, sensible experience and regresses by induction to the **causes**, because his presentation is a propaedeutic, suitable for beginners. Similarly, whereas Descartes sets forth his principles (matter and form only) as the real constitutive principles of things, Aristotle proposes the fundamental concepts of his physics (matter, form, privation) as heuristic principles only. Aristotle does know that there is no real privation in things, Le Bossu contends (1674, 84–89); speaking of privation is only a methodological detour to discover what role the form plays with respect to matter. Thanks to some

adjustments, the Cartesian and Aristotelian concepts of form and of matter are then declared to be compatible. Form, for instance, is to be understood as the arrangement of parts of matter that makes a thing what it is. Along the same lines, Le Bossu (1674, 209–11) even claims that the Aristotelian notion of potentiality is to be interpreted as the relative rest between the parts of a same body, and that the actualization of this potentiality consists in the local motion of this body in Descartes' sense.

Since in unpublished memoirs he apparently supported Descartes' views on **animals** and showed sympathy for his explanation of **transubstantiation**, Le Bossu's interpretation must be seen as a way of making **Cartesianism** acceptable to traditional minds. However, the result of his endeavor is faithful neither to Aristotle nor to Descartes. Although the Marchioness of Sévigné called him "my **Malebranche**," Le Bossu is better remembered as the author of a treatise on epic poems, which received the honor of being praised by Boileau in his third reflection on Longinus's *On the Sublime* and criticized by Voltaire in his *Essay on Epic Poetry*.

See also Body; Cartesianism; Extension; Form, Substantial; La Grange, Jean-Baptiste de; Motion; Rohault, Jacques

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JEAN-LUC SOLÈRE

LE GRAND, ANTOINE (1629–1699)

Le Grand was a Franciscan Recollect friar in Douai, France. He was sent on the English mission to Oxfordshire where his Latin works on Descartes were translated into English. He had disputes with John Sergeant (1623–1707) and Samuel Parker

(1640–88). His major work is *An Entire Body of Philosophy According to the Principles of the Famous Renate des Cartes* (1694). It was very popular and went through many editions.

Le Grand presents the *cogito* and the innate **ideas** of **God**, **mind**, and **body**, plus the **eternal truths** as the foundations of all **knowledge**. Descartes' mechanism explains all bodily interactions and rules out the occult powers of Aristotelian matter. But even though Cartesians have certain knowledge of first principles and eternal truths, the application of these principles and truths to the material world is hypotheticodeductive, and the results are only probable. Thus, experimentation is important in Cartesian **physics**. A great deal of *An Entire Body of Philosophy* is devoted to detailed **explanations** of natural phenomena. Later, expositions of **Newton** often followed Le Grand's plan.

Le Grand provides a Cartesian ontology of things and **modes** to replace Aristotelian categories, but he keeps one **substantial form**, the Cartesian mind. All bodily properties derive from **quantity**, figure, and **motion**, and all action and passion in bodies are reducible to motion. The Aristotelian notion that there is nothing in the **intellect** that was not first in the senses is absurd according to Le Grand because we have innate, general ideas of God, mind, and body.

Le Grand's *Entire Body of Philosophy* was extremely popular in England, and the third book on *The Want of Sense and Knowledge in Brute Animals* was a topic of inexhaustible parlor conversation and theological debate in the late seventeenth century. Le Grand undertook to show in great detail how all **animal** behavior is mechanically generated by bodily interactions in the material world. With respect to bodily interactions generally, Le Grand was a thoroughgoing occasionalist (and reads Descartes as one too) and presents several arguments for God as the true source of causal interaction between bodies (see **cause**). God is also the cause of all mind-body interaction, but this does not require an argument, as it can be explained *only* as a miraculous gift of God – no natural explanation for either type of interaction is possible. Against the inference of **Pierre-Sylvain Régis** (1632–1707) that human souls after death have no **memory** of their bodily lives, Le Grand argues that, given that God effects the miraculous union of mind and body during one's lifetime, then God certainly can (and does) maintain the memory of this bodily life in the soul after death.

God miraculously created **human beings** with consciousness and the ability to control their bodies and the material world. He gave us sensibility so we can know bodies. But **sensations** do not resemble the material bodies that occasion them; they are unintelligible, and thus neither true nor false. God created the eternal truths and gave us innate knowledge of them. Thus, we know ourselves, eternal truths, and the material world; and we have the ability to control ourselves, our bodies, and the material world only because God makes it so. We could not even know that two plus two equals four if it were not for the **existence** of

God. The upshot is that “I think, therefore I am” is equivalent to “I think, therefore God exists.”

See also Animal, Cause, Eternal Truth, Experiment

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RICHARD A. WATSON

LEIBNIZ, GOTTFRIED WILHELM (1646–1716)

Leibniz, who was born in Leipzig and died in Hanover, was one of the greatest intellects of all time. He made significant contributions to a bewildering number of fields of endeavor. Perhaps his most lasting achievement was his discovery of the differential calculus. However, Leibniz also did other pioneering work in **mathematics**, including the invention of the binary number system, and he wrote works in disparate areas of natural **philosophy**, from **physics** and chemistry to geology and botany. He was employed for almost forty years by the court of Hanover as a counselor and charged, among other things to write on a history of the House of Brunswick. In connection with this lengthy project, he collected many documents relating to the history of Europe and the origins of France and Germany. Leibniz also took a serious interest in the **Jesuit** mission to China, which led to writings on Chinese history and philosophy. He also actively engaged in diplomatic work for much of his career and, as well as producing an extensive correspondence related to issues of state, was a tireless champion of the cause of the reunification of Catholic

and Protestant churches. This more practical side of Leibniz's character extended to technological innovation. He invented one of the first calculating **machines** and spent several years in the mining area of Harz attempting to design and build wind-mills that served to drain away water.

As a philosopher, Leibniz is perhaps best known for his claim that the actual world is the best of all possible worlds, as lampooned mercilessly in Voltaire's *Candide*. However, his longevity as a subject of academic study is driven largely by his commitment to the claim that the created world is ultimately composed of an infinite number of unextended, **mind**-like individuals, which he called "monads."

Descartes and **Cartesianism** figure prominently in Leibniz's writings, and it is arguable that much of his philosophy and natural philosophy emerged as a direct response to the Cartesian tradition, which was already becoming dominant by the time he reached his maturity. References to Descartes can be found among the earliest of Leibniz's writings, which date from the late 1660s and early 1670s. His tendency at this point was to focus on Descartes' natural philosophy, and while he clearly drew upon Descartes' ideas, he was critical of Cartesian theses, such as the claim that matter is indefinitely divisible rather than infinitely divided (see **divisibility**). In a letter to **Simon Foucher** from 1675, Leibniz admitted, somewhat surprisingly, that most of his knowledge of Descartes' **metaphysics** and physics to that point had been secondhand. Indeed, his first serious engagement with Descartes' writings was in 1673, when he read the *Geometry* at the suggestion of **Christiaan Huygens**. That was soon to change. During the winter of 1675–76 he made a detailed study of the *Principles of Philosophy* (see 1923, VI iii, n.15), and, in early 1676 Leibniz was granted access to Descartes' unpublished writings by his executor **Claude Clerselier** (some of these survive only as the transcriptions that Leibniz made).

From this point on, Leibniz was in regular dialogue with Descartes' ideas both in the essays that he wrote privately and for publication and in the correspondences that he had with prominent Cartesians, such as **Antoine Arnauld**, **Nicolas Malebranche**, and Burcher de Volder. Many of Leibniz's objections to Descartes' views are summarized in the 1692 *Critical Thoughts on the General Part of the Principles of Descartes*, a commentary on parts I and II of the *Principles of Philosophy* that runs to around 12,000 words (see 1875–90, vol. 4). The significance of this piece is evidenced by the fact that Leibniz tried unsuccessfully to find a publisher (see 1875–90, 4:354–92; 1969, 383–412). Among the most important objections are his critique of Descartes' version of the **ontological argument** on the grounds that it lacks a proof of the possibility of **God**, his denial of the causal interaction between mind and **body** (see **cause** and **human being**), his arguments against the conception of matter as geometrically extended **substance**, and his rejection of Descartes' principle of the conservation of **quantity of motion**, which precipitated the "*vis-viva* controversy" (see **conservation of motion, principle of**). More fatally, Leibniz believed that Descartes' philosophy and Cartesianism generally encouraged Spinozism,

specifically the heresy that God is the only substance and finite things are merely **modes** of God: “Spinoza merely cultivated certain seeds in Descartes’ philosophy” (1875–90, 2:563). He was also contemptuous of Descartes’ rules of **method**: “They are like the precepts of some chemist: take what you need, do what you should, and you will get what you want” (1875–90, 4:329).

See also Body; Cartesianism; Cause; Conservation of Motion, Principle of; Divisibility; God; Mathematics; Mind; Ontological Argument; Physics; *Principles of Philosophy*; Substance

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LIGHT

Descartes' corpuscular-mechanical natural philosophy is intended to replace the Aristotelianism of the late medieval universities and the resurgent Neoplatonic natural philosophies, in which light is conceived as the intermediary between base matter and higher spiritual and immaterial entities. In the simplest version of his theory, Descartes explains light mechanically as a tendency to **motion**, an impulse, propagated instantaneously through continuous optical media. This has the very important implication that in Descartes' theory the propagation of light is instantaneous, but the magnitude of the force conveyed by the tendency to motion constituting light can vary – there can be stronger and weaker light rays, all propagated instantly (Schuster 2000, 261).

Descartes' theory of light cannot be understood in detail without his theory of corpuscular dynamics (see **force and determination**). Descartes holds that **bodies** in motion, or tending to motion, are characterized from moment to moment by the possession of two sorts of dynamical quantity: the absolute quantity of the “force of motion”; and the directional modes of that **quantity** of force, which Descartes calls “determinations.” As corpuscles undergo instantaneous collisions, their quantities of force of motion and determinations alter according to the **laws of nature**. Descartes focuses on instantaneous tendencies to motion, rather than finite translations in space and time. His exemplar for applying these concepts is the dynamics of a stone rotated in a sling (Figure 13) (AT XI 45–46, 85; G 30, 54–55).

Descartes considers the stone at the instant that it passes point A. The instantaneously exerted force of motion of the stone is directed along the tangent AG. If the stone were released and nothing affected its trajectory, it would move along ACG at a uniform speed reflecting its conserved quantity of force of motion. However, the sling continuously constrains what can be termed the “principal” determination of the stone and, acting over time, deflects its motion along the circle AF. The other component of determination acts along AE, completely opposed by the sling, so that only a tendency to centrifugal motion occurs rather than centrifugal translation. It is this conception of centrifugal tendency that Descartes uses when he articulates his theory of light inside his cosmological theory of vortices.

Each **vortex** consists of a central star, made up of the highly agitated and extremely small particles of the first **element**, surrounded by a fluid that rotates around the star. The fluid consists of spherical particles of the second element, which are significantly larger than first-element particles, and which are tightly packed together, maintaining points of contact with each other. The remaining interstitial spaces are filled with first-element particles. As the fluid rotates, the particles of the second element generate centrifugal tendency to recede from the center, but since they are tightly packed together and every vortex is bounded by other

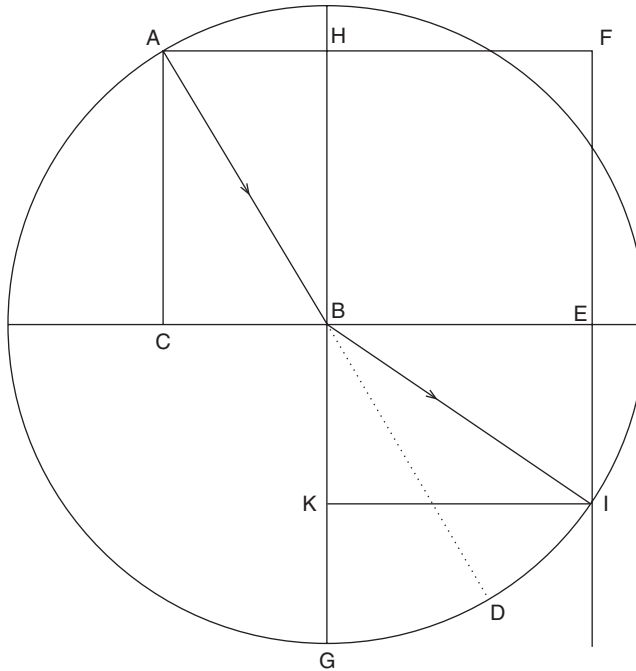


Figure 14. Descartes' figure for refraction of light (tennis ball) (modified from AT VI 100).

writes that prior to impact the parallel determination “caused” the **body** to move toward the right between lines AC and HBG. For condition (b) he considers that after impact, the ball takes $2t$ to move to the circle's circumference, so its unchanged parallel determination has twice as much time in which to act to “**cause**” the ball to move toward the right. He sets FEI parallel to HBG so as to represent that doubled parallel travel. At time $2t$ after impact the ball will be at I, the intersection of FEI and the circle point below the cloth. It follows that $(\sin i / \sin r) = (AH/KI)$ or 0.5 for all angles of incidence.

Descartes' published proof is superficially kinematic. But if we consider his corpuscular dynamics and the fact that his tennis ball is virtually a mathematical point in motion, we can translate Descartes' proof into the terms of his actual theory of light as instantaneously propagated tendency to motion (Figure 15). Consider a light ray incident upon refracting surface CBE. Let length AB represent the magnitude of the force of the light impulse. The *orientation* and *length* of AB represent the principal determination of the ray. The force of the ray is diminished by half in crossing the surface. So, to represent condition (a) we draw a semicircle below the surface about B with a radius equal to one half of AB. As for condition (b), the unchanged parallel determination, we simply set out line FEI parallel to HBG and AC so that $AH=HF$.

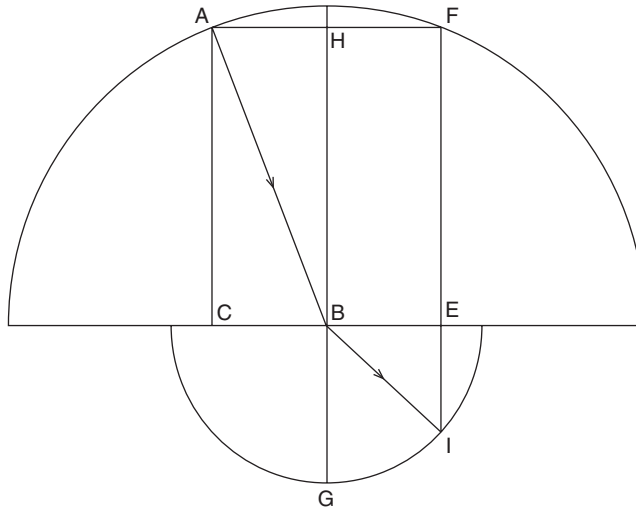


Figure 15. Refraction of light using Descartes' dynamics and real theory of light (Source: John Schuster).

The resulting intersection at I gives the new *orientation* and *magnitude* of the force of the ray of light, BI, and the law follows, as a law of cosecants. The case of the light ray requires manipulation of unequal semicircles, representing the ratio of the force of light in the two media. In the tennis ball case, Descartes moves from the ratio of forces to the ratio of speeds and hence the differential times to cross *equal* circles. But at the instant of impact the same force and determination relations are attributed to the tennis ball and the light ray.

The derivation of the long-sought law of refraction using the principles of his dynamics of corpuscles marked the high point of Descartes' optical researches, along with his application of the law to the **explanation** of the telescope and to an ingenious solution of the equally long-standing problem of explaining the **rainbow** (see **optics**). However, the full meaning of Descartes' optical triumph in relation to the overall development of his corpuscular-mechanical natural philosophy can be grasped only by looking at how his optical work unfolded over time, starting with his discovery of the law of refraction in Paris in 1626–27 while collaborating with the mathematician **Claude Mydorge**. This was accomplished independently of, but in the same manner as, Thomas Harriot, who first discovered the law around 1598 (Figure 16).

Harriot used the traditional image-locating rule to map the image locations of point sources taken on the lower circumference of a half-submerged disk refractometer (Lohne 1963; Buchdahl 1972). This yielded a smaller semicircle as the locus of image points and hence a cosecant law of refraction of light. In a letter describing

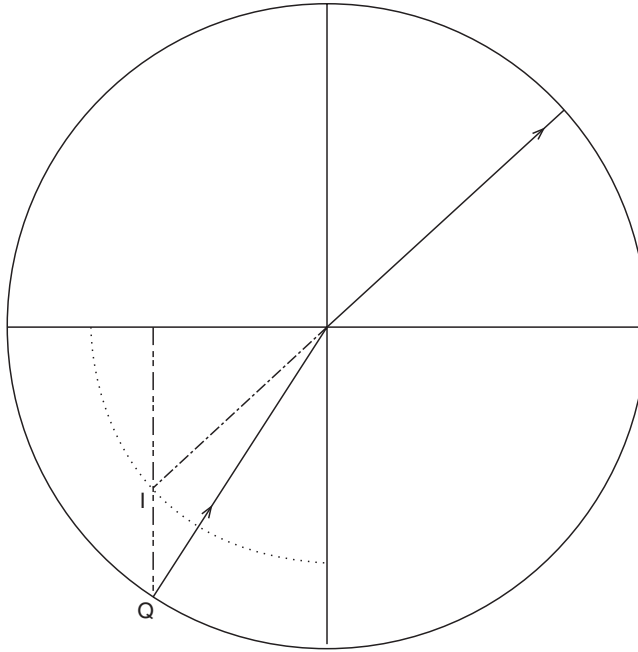


Figure 16. Thomas Harriot's cosecant form of the law of refraction (Source: John Schuster).

an identical cosecant form of the law, Mydorge presents a virtually identical diagram (Figure 17) but moves the inner semicircle above the interface as a locus of point sources for the incident light (Mersenne 1932–88, I 404–15; Schuster 2000, 272–73).

Figure 17 closely resembles Figure 15, the derivation of the law of refraction using Descartes' conditions from the *Dioptrics* and his theory of light as an instantaneously propagated tendency to motion. It is the key to unpacking the coevolution of Descartes' theory of light and his dynamics of corpuscles.

After his discovery of the law of refraction by these purely geometrical optical means, issuing in the cosecant form of the law, Descartes sought to explain the law by use of a dynamics of corpuscles. Working in the style of his “**physico-mathematics**,” he transcribes into dynamical terms some of the geometrical parameters embodied in the cosecant representation. The resulting dynamical principles concerning the mechanical nature of light are: (1) the absolute quantity of the force of the ray is increased or decreased in a fixed proportion, while (2) the parallel component of the force of a light ray is unaffected by refraction. These are effectively the conditions (a) and (b), which control the derivation of the law of refraction in the *Dioptrics*, and this is how he arrived at them, as is confirmed by the fact that by late 1628 Descartes used these concepts to explain the law of refraction to his friend **Isaac Beeckman** (AT X 336; Schuster 2000, 290–95).

See also Beeckman, Isaac; Force and Determination; Hydrostatics; Law of Nature; Mechanics; Mydorge, Claude; Optics; Physico-Mathematics; Physics; Rainbow; Vortex

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JOHN A. SCHUSTER

LOCKE, JOHN (1632–1704)

Locke was born in 1632 in Somerset, England, to a Protestant landowner. At the age of fifteen, he enrolled in the Westminster School before going on to Christ Church, Oxford. In 1666 he met Anthony Ashley Cooper (the future Earl of Shaftesbury), who was to become his patron and whom Locke was to serve as secretary for much of his life. Locke shared the political vicissitudes of Shaftesbury's career and fled to the Netherlands in 1683, fearful of being charged with treason. After the Glorious Revolution, Locke returned to England; from 1692 until his death, he resided with Sir Francis and Lady Masham, the daughter of **Ralph Cudworth**.

Locke's main metaphysical and epistemological work is the mammoth *An Essay concerning Human Understanding*, which he published in 1689 and revised five

times before his death. Although Locke rarely mentions Descartes by name in the *Essay*, much of that work can profitably be read as a running battle with him. Many of Descartes' key positions – on innate **ideas**, the **essence** and immateriality of the soul, the nature of **body** as **extension** – come under attack.

Locke rejects Descartes' doctrine of innate ideas. If the doctrine means that we have ideas before we are aware of them, it is self-contradictory, for no idea can be in the **mind** without our being aware of it. If, as Descartes sometimes suggests, it means only that we have a capacity or disposition to form certain ideas, then it is trivially true of *all* ideas (I.ii.5). Nor does Locke have any use for the Cartesian **intellect**. In the Sixth Meditation, Descartes uses the example of a chiliagon to show that we have a capacity for forming ideas that outstrips our ability to generate images. The idea of the chiliagon must then come from the intellect. Against this, Locke argues that, while we have no idea of the *figure* of the chiliagon, we can reason about its properties by attending to the idea of the number of its sides (II.xxix.13).

Although Locke endorses Descartes' *cogito ergo sum* (II.i.10), he denies that we can know the nature of the thinking **substance**. Descartes' claim that **thought** is the essence of the mind entails that the mind always thinks, even though it is of course not always aware of having done so. Locke finds this simply implausible; only philosophers "in love with their opinions" (II.i.10) could hold such a view. Moreover, if Descartes were right, there would in fact be two "persons" in each of us. If a person while asleep has a series of thoughts that can never be brought to consciousness by the waking self, then, according to Locke, the waking and sleeping persons are two, and not one.

For Locke, then, what makes identity of a person over time is continuity of consciousness, not sameness of substance (II.xxvii.23). This is just as well, since we can never be sure whether our consciousness resides in a single substance that persists through **time**; still less can we know whether that substance is material or not (IV.iii.6). "All the great ends of morality and religion" can be secured, Locke thinks, without a proof of the soul's immateriality.

In the *Principles* (AT VIIIA 30–31, CSM I 215), Descartes identifies a substance with its essence or nature. Just as the mind is thought, so body is extension. Locke argues that "body" and "extension" signify distinct ideas (III.x.6), for body includes the notion of solidity, which mere extension does not. Descartes might agree and require us to revise our idea of body. To this, Locke responds that whichever idea of body corresponds to the world is "left to our senses to discover to us as far as they can" (IV.vii.12–15), implying that the picture of body as more than mere space is justified by experience.

Locke defends a view of substance as an unknown something that supports the qualities we observe. By contrast, Descartes' identification of a substance with its nature obviates the need to postulate a substratum or underlying something in which the property of extension (or thought) inheres. In an intriguing letter, Locke

claims that he does “not at all understand the Cartesians’ way of talking.” “I can by no means persuade myself,” Locke writes, “that thought exists of itself, but only that a thinking thing or substance does so” (Letter 2498 in Locke 2002, 270).

See also Attribute, Body, Essence, Extension, Idea, Intellect, Mind, Substance, Thought

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WALTER OTT

LUYNES, DUC DE (LOUIS-CHARLES D’ALBERT) (1620–1690)

Luynes was born the son of Charles d’Albert (1578–1621), first duc de Luynes and chief favorite of Louis XIII. Still an infant, Louis-Charles became second duc de Luynes. In 1639 he obtained the title of *pair* (Peer of the Realm) and in 1643 was given the title of *grand fauconnier* (Great Falconer). As an officer he distinguished himself during the Flanders campaign (1640). He died in Paris, October 10, 1690. To exercise his style on a great subject (Baillet 1691, 2:171), Luynes translated Descartes’ *Meditations* into French. The result was given to Descartes (probably by **Picot**) during his visit to Brittany in the summer of 1644 (Baillet 1691, 2:219). After his return to Paris in October, Descartes visited the duc to thank him for the honor (Baillet 1691, 2:243). Meanwhile **Clerselier**, who as yet did not know Descartes directly, translated not only the *Meditations* but also the *Objections and Replies*. Although both versions were found to be “excellent,” Descartes preferred Luynes’ for the publication, because that would give “high profile” (Baillet 1691, 2:171) to his work.

Still, he accepted Clerselier's for the *Objections and Replies* (which the duke had not translated). Both Luynes and Clerselier insisted that all texts should be revised by Descartes, which he did. Although that fact makes it difficult to judge Luynes' translation, it also turned it into the classical French version of the *Meditations*. Even so it remains prudent to keep the original Latin text at hand.

See also Clerselier, Claude; *Meditations on First Philosophy; Objections and Replies*; Picot, Claude

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THEO VERBEEK

MACHINE

Discussions about Descartes and machines usually focus on two themes: his fruitful insights about the simple machines, which advanced the science of statics beyond the available ancient, medieval, and renaissance treatises on the subject; and his employment of a metaphorical understanding of machinery, notably clockwork, in the explanation of corpuscular-mechanical natural philosophy. In the former case, his positive contribution is taken to be important but not of great relevance to his larger scientific projects. In the latter case, it is considered unfortunate that Descartes worked before the discoveries of **Newton** and others, who created a “classical mechanics” that allows for a better engagement with the properties of real mechanisms, of which Cartesian and Newtonian universes are allegedly both composed. However, recent research on Descartes and the history and foundations of mechanical engineering casts his theorizing about machines, and allied concepts at the center of his natural philosophy, in a more favorable light.

Actual working machines, including those known to Descartes and his contemporaries (such as clockworks, winches, and pulley systems) are composed of rigid parts (pinned together or linked with ropes and conveyor belts) maintained in constant, constrained contact, the results forming what is termed a “closed kinematic chain” in the mechanical literature. What is popularly called a “clockwork universe” in Newtonian **physics** – **bodies** operating under a force of mutual gravitation acting at a distance – does not constitute a “mechanism” in this sense. In fact, the doctrines that engineering students learn to understand how machines operate differ considerably from what gets taught under the heading of Newtonian mechanics. The special characteristics of mechanisms were lucidly isolated in the nineteenth century by Franz Reuleaux, the founder of modern machine design (Reuleaux 1876, Ferguson 1962). Reuleaux himself stressed the fact that the principles he articulated had clearly been appreciated in wholly intuitive ways by the great inventors of the past. Some of Descartes’ physical conceptions, vital to his overall natural philosophy, arguably manifest a similar grasp of machine behavior, although he experienced great difficulty in articulating such doctrines clearly. Viewed in this light, his letters on the “simple machines” of antiquity demonstrate this specialized understanding and indicate the potential role of such thinking within his wider philosophical views, where the behaviors of more complex mechanisms become central. In short, many of the features for which his natural philosophy is often criticized appear quite natural when approached from the special perspective of “mechanism” (see **mechanics**).

Here are six behavioral features that characterize “mechanisms” in the strict sense employed here:

1. Such devices can execute *clean force conversion*, in that any input force applied to such a device will be modified or redirected into an output activity of a

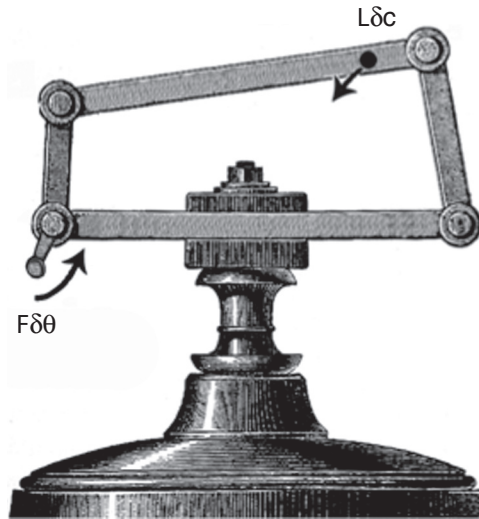


Figure 18. Clean force conversion (modification of a woodcut from Franz Reuleaux's *Kinematics of Machinery*, 1875–76).

different character without significant loss of *work capacity*. In the four-bar mechanism illustrated (Figure 18), an input force F turned through an infinitesimal angle $\delta\theta$ becomes “converted” to an ability to put a load L along an infinitesimal curve of length δc .

2. Such conversion never creates additional “work capacity” and remains subject to the restriction that no perpetual **motion** device can be devised upon its basis.
3. In complex mechanisms, consisting of at least four rigid parts assembled into a closed kinematic chain, the *efficiencies* of the force conversions differ considerably from moment to moment in the machine’s cycle (in fact, this same shifting efficiency also affects levers in minor ways, as Descartes pointed out).
4. Because of these adjustments, appeals to infinitesimal (or “virtual”) motions are required to frame the rules for the relation of input to output work within a mechanism correctly.
5. The same work capacity relationships apply when the locales where forces get applied and extracted become reversed (i.e., the input effort is applied to the top of our four-bar linkage and the output work is extracted at the crank handle). This important rule of reciprocal behavior is termed an “inversion of the mechanism” by engineers.
6. Because the internal parts of such machines are usually rigid, such effects will be transmitted across their interiors instantaneously.

Descartes' central comments on the behavior of the traditional "simple machines" can be found in two celebrated letters to **Constantijn Huygens** on October 5, 1637, and to **Marin Mersenne** on July 13, 1638 (see AT I 435–47, CSMK 66–73; AT II 222–39, CSMK 111–18). Pierre Duhem, the leading historian of ancient and modern statics, remarks that Descartes is one of the first writers who clearly isolated the role of what became later called *virtual work* (i.e., pairings of the form $L\delta c$) in such devices and distinguished this purely static behavior from the faulty dynamical assumptions concerning weights or loads traversing finite spaces at given speeds with which such principles had been heretofore muddled (e.g., in the pseudo-Aristotelian *Mechanical Problems* that informed much sixteenth- and early seventeenth-century thinking about mechanics and the simple machines) (see **hydrostatics**). Duhem (1991, 241) wrote: "Descartes clearly understood and underscored the infinitesimal property of the principle of virtual [work] and he states what nobody had explicitly formulated before him: the necessity to apply this principle to an infinitely small displacement originating from a state of equilibrium." In Descartes' own terminology, we need to calculate such relationships within mechanisms in moments when the relevant bodies "have not yet begun to move" (AT II 227, CSMK 113).

Such considerations gain an immediate salience with respect to Descartes' wider views on the universe as soon as these doctrines are extended to more complex devices than levers and winches – to the nontrivial "kinematic chains" that display *internal mobilities* in the manner of the four-bar linkage illustrated (most textbooks in machine science employ this assembly as their central paradigm of a 'complex mechanism'). Our six "work principles" apply to such devices, but their greater structural complexity now allows input work to become *temporarily stored as internal movement* until such time as an agent wishes to extract that stored capacity as output work rather in the manner of a flywheel. As such, we have moved beyond the traditional limitations of "statics" into realms of dynamical behavior founded upon very similar principles (this extension is not possible for "Newtonian" systems of a more general character). It should be observed that many explanatory structures central to Cartesian physics qualify as "mechanisms" in the sense employed here, even if they do not immediately so appear. This is particularly true of Descartes' celebrated *vortices*, which comprise "closed kinematic chains" of the sort studied in the theory of machines, although their parts are held together through exterior pressure (what engineers now term "force closure") rather than through *internal pinning* as in our four-bar assembly (see **vortex**). His vortices likewise store conserved work capacity in their internal cyclings, until such time as interactions with outside mechanisms drain or increase that stored capacity.

Descartes recognized that, in ordinary life, frictional processes will eventually slow such internal cycling to a halt, but at the level of his micromechanical theory of matter, he regarded friction as simply the result of performing small amounts of

work upon neighboring vortices that are too minute to see, so he did not think he needed to include “friction” as an additional element within his fundamental principles. Under such assumptions, we reach a simple and pleasing picture of how “**quantity** of motion” remains conserved within the universe’s physical activities: either any fresh capacity to perform work is transmitted fully across a mechanism’s span in a pattern of immediate statical conversion, or its unexpended residue becomes stored within the device’s internal movements. This picture is quite conformable to Descartes’ actual claims, while reflecting to a considerable degree the doctrines that became later codified as the basic percepts of mechanical engineering. But such principles make little sense for arbitrary “Newtonian” systems that are not capable of “clean force conversion” in the manner of our first work principle.

Correlatively, Descartes’ views on the mechanical generation of **light** make better sense when his vortices are viewed from this perspective. The salient observation with respect to such “force closed” vortices is that they will generally not perform work upon their bordering regions (in the sense of losing “quantity of motion” to them), despite the fact that these same neighbors play a central role in maintaining the individual vortices as distinguishable mechanisms within the larger universe. Descartes’ theory of light trades upon the presumption that a *capacity to perform work* (which he often dubs a “pressure”) can be completely transmitted instantaneously across a vortex tube in a “statical” manner that will not alter the work capacity stored within the tube itself.

It is possible to go further into this sort of analysis, although that would take us beyond the scope of the present volume. Descartes was not able in a wholly consistent manner to develop rules for how cycling mechanisms manage to store work capacity (although his thinking belongs to a long history of what are sometimes called “generalized principles of **inertia**”). His views on the proper measure of “quantity of motion” and the vectorial quantity he called “determination” also trace to this source. Descartes’ notorious “relationalism” with respect to space is probably motivated in part by intuitions connected to the “inversion of the mechanism” behaviors that typical machines display. More details on these issues can be found in Wilson (forthcoming).

In sum, as commentators such as Ernst Mach have observed, it was Descartes, rather than Newton, who genuinely attempted to model the inanimate cosmos in the fashion of genuine clockwork (or, to put the matter more accurately, as a gigantic tangle of vortex-like structures operating as complex interlaced mechanisms in the modern engineer’s sense). Many of the features for which Descartes’ physics is often criticized appear quite natural when approached from the special perspective of true “machines,” both as Descartes knew them and as they are still studied within mechanical engineering.

See also Body; Force and Determination; Hydrostatics; Inertia; Light; Mechanics; Motion; Newton, Isaac; Physics; Vortex

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MARK WILSON

MAGNETISM

Magnetism, long considered the exemplar of an occult, spiritual power, posed a challenge to mechanical philosophers like Descartes. William Gilbert's *De Magnete* (1600) offered an impressive natural philosophy, grounded in **experiments**, which could lead to interpreting magnetism as an immaterial power that possesses in its higher manifestations the capabilities of soul or **mind**. In his *Principles of Philosophy*, Descartes accepts Gilbert's experiments, but he explains magnetism mechanistically, according to the movements of two species, right – and left – handed, of “channeled” or cylindrical screw-shaped particles of his first **element**. Descartes claims that magnetic bodies – naturally occurring lodestone, or magnetized iron or steel – have two sets of pores running axially between their magnetic poles: one set accepts only right – handed channeled particles; the other set of pores accepts only the left – handed particles. Descartes thus explained Gilbert's experiments, including his use of a sphere of loadstone, to demonstrate the properties of magnetized compass needles.

However, Descartes did more than appropriate and reinterpret Gilbert's “laboratory” work. Gilbert called his sphere of lodestone a *terrella*, a “little earth,” arguing that because compass needles behave identically on the *terrella* as on the earth itself, the earth is, essentially, a magnet. Hence, according to his natural philosophy, the earth possesses a magnetic “soul,” capable of causing it to spin. Magnetic “souls” similarly **cause** the **motions** of other heavenly bodies. In his *Principles*, Descartes, aiming to displace Gilbert's natural philosophy, focuses on the “cosmic” genesis and function of his channeled magnetic particles. Descartes argues that the spaces between the spherical corpuscles of the second element that make up his vortices are roughly triangular, so that particles of the first element, constantly being forced through the interstices of second-element spheres, become “channeled” or “grooved” with triangular cross sections. Such first-element corpuscles tend to be flung by

centrifugal tendency out of the equatorial regions of vortices and into neighboring vortices along the north and south directions of their axes of rotation, thus receiving opposite axial twists (see **vortex**). The resulting left – and right – handed screw shaped first-element particles penetrate into the polar regions of central stars and then bubble up toward their surfaces to form, Descartes claims, sunspots. Stars are thus magnetic, as Gilbert maintained, but in a mechanistic sense.

Moreover, for Descartes, planets are also magnetic, as Gilbert claimed, but again the **explanation** is mechanical. Descartes describes how a star may become totally encrusted by sunspots. This extinguishes the star, its vortex collapses, and it is drawn into a neighboring vortex to orbit its central star as a planet. But such planets, including our earth, bear the magnetic imprint of their stellar origins, by possessing axial channels between their magnetic poles accommodated to the right- or left-handed screw particles. Descartes' explanation ranges from the cosmic production of magnetic particles, through the nature of stars and sunspots, to the birth and history of planets. He accepts the cosmic importance of magnetism but renders the explanation mechanical, thus binding his natural philosophy into a cosmogonical and cosmological whole.

See also Cosmology, Element, Experiment, Explanation, *Principles of Philosophy*, Subtle Matter, Vortex

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JOHN A. SCHUSTER

MALEBRANCHE, NICOLAS (1638–1715)

Malebranche entered the Parisian Oratory in 1660 and was ordained into the priesthood in 1664, the same year as he discovered Descartes' work. Descartes' philosophy, especially its mechanical approach to **physics**, appealed greatly to Malebranche: but, less satisfied with Descartes' treatment of more spiritual and divine matters, he also turned back to his other great mentor, **Saint Augustine**. Over the next few years, he sought to effect a synthesis between Cartesianism and Augustinianism, which he unveiled in *The Search after Truth* (1674–75). Other works followed, including *Treatise*

of *Nature and Grace* (1680), *Treatise of Ethics* (1684), and *Dialogues on Metaphysics and on Religion* (1688). Alongside his own works, Malebranche was also quick to enter into exchanges with other authors, sometimes constructive, but often descending into acrimonious polemic. There were important private correspondences with Dortous de Mairan and **Leibniz**; and public disputes with **Simon Foucher**, **Pierre-Sylvain Régis**, Louis de la Ville (pseudonym of Louis le Valois), Bernard de Fontenelle, **François Lamy**, and (most bitterly and extensively) **Antoine Arnauld**.

Philosophically, Malebranche agrees with Descartes about mind-body **dualism** and union, about the **essences** of matter and soul as **extension** and **thought** respectively, and about the importance of turning to the **intellect** rather than the senses or **imagination** in order to avoid error. However, whereas Descartes maintains that the **existence** of the external world can be philosophically demonstrated from the veracity of **God**, Malebranche claims that such an argument shows only that its existence is probable. To achieve **certainty**, we must turn to **faith**. As for the workings of this world, although he shares Descartes' passion for mechanism, Malebranche maintains that Descartes errs on a few of the details. Whereas Descartes treats rest as something positive, Malebranche regards it as merely the privation of **motion**, a difference that has knock-on consequences for their respective accounts of the laws of motion.

Another divergence lay in their attitudes to the **eternal truths**. Whereas Descartes maintains that God has dominion over these, Malebranche insists that not even an omnipotent God could alter them. He holds that such truths – moral as well as mathematical – subsist as relations among God's own uncreated **ideas**. But, since those ideas are consubstantial with God himself, they share his immutability. Such ideas are also the eternal essences of things, the archetypes that God consults as he fashions his creatures. Following Augustine, Malebranche hypostasizes these ideas collectively as the Word, the second Person of the Trinity, and wisdom of God. And he also believes, with Augustine, that God grants us epistemological access to these ideas. Rejecting the Cartesian doctrine that we each have our own innate ideas, Malebranche holds instead that we can all discover eternal truths and essences through an illuminating union with the single set of ideas in the Word – but only in some cases. By intellectually apprehending “intelligible extension,” that is, God's own idea of matter, we can discover general truths of **geometry** and **mechanics**. But, whereas Descartes claims that the **mind** is better known than the **body**, Malebranche holds that mind is not really *known* at all. Although God himself must have an archetypal idea of thought, he does not reveal it to us. At best, we can achieve a confused introspective awareness of our own minds, but we cannot properly understand their essence (meaning that, unlike physics, psychology can never be made an exact science).

But then Malebranche goes further, explaining how God's ideas – and intelligible extension in particular – can be the immediate objects of our minds not only in intellectual conception but also in sense **perception**. He draws a contrast between

“ideas” and “**sensations**.” The latter are indeed peculiar to this or that mind, but they are just **modes** of thought, not objects in their own right but merely different *ways* of apprehending the eternal divine ideas themselves. When our union with these ideas is unmodified, we can intellectually discover the general essences of things. (Malebranche believed that all ideas represented generally, and he regarded God himself as being in general rather than as a particular being.) When it is modified by a sensation, we can learn of the existence of particular things. Malebranche follows Descartes in distinguishing the mechanical modes of extension, such as **shape**, from merely **sensible qualities** like color. For him, intelligible extension represents the former, whereas the latter pertains instead to sensations. So if we perceive, for instance, a round portion of intelligible extension in a yellow way, this would constitute a visual impression of a yellow circle. By bringing this about when our eyes were trained on the sun, God would enable us to perceive the sun – but only indirectly. Such is Malebranche’s theory of vision in God: notwithstanding its representational content, the immediate object of our perception is not a body but an idea in the Word, and the Word is with God, and the Word is God.

Another distinctive feature of Malebranche’s system is his **occasionalism**, whereby God is the only truly efficacious **cause**. God regulates his behavior by means of **laws of nature**, ensuring constant conjunctions among mundane events of various kinds, be they physical or mental: whenever he produces an event of one kind, he follows it with an event of another, associated kind. Because we are so utterly dependent on God in all respects – perceptually, causally, and otherwise – Malebranche concludes that God alone is the proper object of our love. And the lawlike regularity of God’s behavior is also an important element in Malebranche’s theodicy. He accepts that, in order to glorify himself, God wishes to create the most perfect world possible; but he maintains that the world should reflect not only God’s benevolence but also his fecundity and wisdom. The result is a world that achieves the optimal balance between the intrinsic perfection and plenitude of the work itself, and the simplicity of the ways in which it is regulated. If the rigidity of the laws of nature should sometime lead to natural disasters, this is a cost that God was willing to pay, for it is outweighed by the benefits of having fixed laws of nature at all.

See also Arnould, Antoine; Body, Proof of the Existence of; Cause; Eternal Truth; God; Idea; Law of Nature; Quality, Sensible

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JASPER REID

MATHEMATICS

According to many of its past and present readers, and maybe the author himself, the *Geometry* forms the core of Descartes' mathematical practice. From the point of view of its posterity, this judgment seems uncontroversial. By identifying the “geometrical” and the “algebraic,” the treatise from 1637 opened a new era in **mathematics**. It is well known that other (“infinitesimal”) techniques were also used by the philosopher in his **correspondence** when dealing with the quadrature of the cycloid or “**Debeaune's** problem” (Houzel 1997). But even when one acknowledges these other techniques (dealt with only outside of the published treatise), the comparison with the *Geometry* seems the proper background to assess Descartes' practice. Yet this comparison raises the following questions: Is the *Geometry* the ending point of a continuous and self-conscious evolution? Is it part of a homogeneous and coherent practice characterizing Descartes' mathematics as a whole?

These questions are of interest not only for historians of mathematics. The *Discourse on Method* presents in effect the study of mathematics as a privileged field where the famous “**method**” is developed. Just after the statement of the four “rules,” Descartes mentions as an origin for his methodology “the long chains of reasonings, every one simple and easy, which geometers habitually employ to reach their most difficult proofs” (AT VI 19, CSM I 120). Symmetrically, it is with mathematics – the most simple and certain science – that one has to start the inquiry. However, he then makes clear that one need not learn the whole of mathematics but only what forms

its core: the study of “ratios and proportions,” which he proposes to represent by lines, which in turn are represented by symbols (AT VI 20, CSM I 121). The program exposed by Descartes in *Discourse* II seems to have been achieved: starting from the three disciplines he learned when he was young (logic, geometrical analysis, and algebra), Descartes finally succeeds in finding a method that “retained the advantages of all three but was free from their defects” (AT VI 17, CSM I 19).

But there is more to say about the role of mathematics in the development of Descartes’ method, since it is in the resolution of mathematical problems that it was first tested:

And indeed, I venture to claim that the scrupulous observance of the few precepts I had chosen gave me such ease in unraveling all the questions covered by these two branches of **knowledge** [i.e., geometrical analysis and algebra] that in the two or three months I spent investigating them, having begun with the simplest and most general (every **truth** that I discovered being a rule that I used afterwards to find others), not only did I solve some which I had earlier judged very difficult, but it also seemed to me, towards the end of this period, that I was able to determine, even in respect of those questions which I had not solved, by what means and to what extent it was possible to solve them. (AT VI 20–21, CSM I 121)

According to this narrative, Descartes was engaged in a new and fruitful mathematical practice as early as the beginning of the 1620s. In the third part of the *Discourse*, he claims to have applied his method for nine years to mathematical and other difficulties “closely resembling those of mathematics” (AT VI 29–30, CSM I 125). It seems then of prime importance to determine what this first mathematical practice was and what relationship it bears to the one presented in 1637. In what follows, the focus is on the evolution of Descartes’ mathematical practice and its relation to the “method” (see *Geometry* for Descartes’ mature mathematics).

The relevant set of texts is well delimited. It consists of “a small register in parchment” consisting of eight folios and indicating January 1, 1619, on its first page. The mathematical passages are mentioned in the Stockholm inventory under the title *Parnassus* and are preserved, at least partially, in a copy made by **Leibniz** (see *Private Thoughts*; Leibniz’s copy is lost and was reconstructed from the faulty transcription by Foucher de Careil in AT X 213–48); to this first document, one should add the evidences concerning mathematics in Descartes’ preserved letters, the information given by **Isaac Beeckman** in his *Journal*, and two unfinished treatises: one on methodology in which mathematics plays a pivotal role, the *Rules* (AT X 459–469, CSM I 70–76); another of pure mathematics (geometry of polyhedra and arithmetic of polyhedral numbers), the *Progymnasmata de Solidorum Elementis* (AT X 265–77; known by a copy by Leibniz, which seems to be incomplete compared to what is

described in the Stockholm inventory). To this set of documents, one should add some passages from the so called *Excerpta mathematica* (AT X 277–323), which seem to date back from the period under consideration (1619–29).

The mathematical practice contained in these documents seems remote from what is presented in 1637. First and foremost, we do not have *any* document before 1629 in which Descartes engaged in the kind of practice that forms the core of the *Geometry*: the algebraic analysis of complex geometrical problems (i.e., beyond “solid problems”). We know that **Goli**us transmitted to Descartes at the end of 1631 the famous “Pappus problem,” which is at the center of the treatise from 1637 (AT I 232). The only earlier document in which an algebraic analysis of geometrical problems is conducted is the series of texts concerning the “ovals” (AT X 310–24), which seems to date from after 1629 (i.e., from after the general resolution of the anaclastic problem by Beeckman, AT X 341; cf. Maronne 2010). Another interesting document is the “construction” of the solution to the third- and fourth-degree equations by the intersection of a parabola and a circle (transmitted to Beeckman at the beginning of 1629; AT X 344–46). This equation can be seen as an expression of the insertion of two proportional means, for which Descartes already proposed a geometrical construction in 1625. In the *Geometry*, it is presented in the algebraic setting, but we do not know if this was already the case before 1629. The fact that the two approaches (geometrical and algebraic) are still presented *separately* by Beeckman in 1629 seems to go in the opposite direction (*pace* Bos 2001, 255–60; see AT X 342–43, 344–45).

Arguments *a silencio* are always suspect. Fortunately, there is also strong positive evidence that Descartes had not established the foundations of his *Geometry* by 1629 (although, as testified by the letter to Beeckman from March 26, 1619, he had something like its rough general program in mind as early as 1619; see AT X 154–60 and **geometry**). For example, he explains to **Mersenne** in 1629 that the division of an angle into 27 or 29 parts cannot be dealt with “geometrically” but only “mechanically” (AT I 25–26). Yet, according to the criteria given in the second part of the *Geometry*, not only should these two questions be considered as “geometrical,” but the first one would reduce to the repetition of the trisection of an angle, which occupies a central role in the third part of the treatise (AT VI 470–73). No less remarkable is the fact that even in 1630, in a reply to Mersenne about interesting geometrical challenges, Descartes mentions only *plane* problems (AT I 139). As late as 1633, he proposes to Stampioen as an example of interesting problems a question about figurate numbers and polyhedron inscribed in a sphere, in the vein of the problems dealt with in the *De Solidorum Elementis* (AT I 278) (see **The Stampioen Affair**). These examples would tend to confirm Henk Bos’s (2001, 283) hypothesis according to which the Pappus problem was “the crucial catalyst” that provided Descartes “with a new ordered vision of the realm of geometry and ... shaped his convictions about the structure and the proper methods of geometry.”

Another surprise comes from the variety of Descartes' mathematical interests before the 1630s: theoretical problems pertaining to numbers (AT X 241, 293–96, and also several pieces mentioned in the Stockholm inventory and now lost; cf. AT X 6, 10), arithmetic of figurate numbers (AT X 241), computation of geometrical magnitudes (AT X 285–92), solid geometry (AT X 246–48), **physico-mathematics** (catenary curve, gnomonic, falling bodies) (AT X 219–20, 223, 229), and solutions to algebraic equations (AT X 234–40). Moreover the tools used in this corpus seem very different from the one used in 1637: the equations are first solved “mechanically” in 1619, with the help of the famous Cartesian proportional compasses; the symbolical manipulations contain trivial errors; and, even in the later texts, the formalism used before 1630 is more often than not the archaic cossic notations. This does not amount to drastic mathematical limitations. If the algebraic results from 1619 leave the reader perplexed, the *De Solidorum Elementis* shows a young man already able to achieve, through cossic notations, complex algebraic computations. The most important of these is the first algebraic demonstration that it is not possible to construct other regular convex polyhedra than the five platonic solids – a result that was often considered at the time as the summit of Euclid's *Elements* (cf. Mehl 2003).

This may be the occasion to emphasize connections entertained by the young Descartes to the German Cossist circles, which were rediscovered in the past twenty years and have shed new light on his formative period (Schneider 1993 and 2008, Mehl 2001). The fact that cossic notations were cumbersome led first to the assumption that their techniques were weak, whereas a more careful analysis has shown how advanced they were and how close to Descartes' (Manders 1995 and 2006; Schneider 2008). This may have been the ground for a first formulation of a Cartesian theory of equations (Manders 2006), perhaps transcribed in the lost treatise of algebra mentioned to Beeckman in 1628 (AT X 331–32) and to Mersenne ten years later (AT I 501). But it is one thing to have a powerful theory of equations already at hand, quite another to use this algebra to reform geometry – an enterprise that left no traces, as we have seen, in the extant corpus before 1630.

This is not to say, of course, that no continuity can be detected between the two corpuses. The *Rules* (the date of which is uncertain) develops a methodological setting very close to that sketched in the *Discourse*. In particular, the relationship of the method to mathematics, the model of **certainty**, is much more detailed in the former. One finds again the idea that what forms the core of mathematics is a certain “general science” of order and measure (AT X 378–79, CSM I 20), with Rule 14 presenting them as the two categories under which ratios can be classified (AT X 451, CSM I 64). In Rule 6, when explicating what the “search for the simple” core of the “method” means, Descartes relies on an example taken from theory of proportion. On this occasion, he even states that the study of proportions “encompasses the essential core of the entire science of pure mathematics” (AT X 385, CSM I 23). Finally, mathematics takes a central place in the second part of the treatise with a

first sketch of geometrical calculus meant to solve all the determinate questions, mathematical or otherwise. The basic operations of this calculus are presented as manipulations of segments and rectangles (AT 461–68, CSM I 71–76). After this general presentation, Descartes formulates a series of rules indicating how to deal with questions through equations, which bear a strong resemblance to passages from the *Geometry* (Rules 19, 20, and 21, of which only the titles remain; AT X 468–69, CSM I 76).

There is, however, no question of classifying geometrical problems in the *Rules*, and the word “curve” does not even occur in the extant texts. The mathematical practice is rudimentary, and the most complete copies stop just before the question of inserting one proportional mean. Moreover, the practice is weak: Descartes maintains different representations for discrete and continuous quantities (points on one side, lines and rectangles on the other; see AT X 450; CSM I 64 and AT X 453, CSM I 65–66) and thus prevents the realization of a truly general geometrical calculus (Rabouin 2010). Even if one stays inside the geometrical domain, the absence of the circle seems highly problematic (Bos 2009, Rabouin 2010). Yet these two features correspond exactly to the evidence given by Beeckman about Descartes’ algebra in 1628 (*Algebrae Des Cartes specimen quoddam*, AT X 333–34). More interestingly, it corresponds to the practice in the extant part of the *De Solidorum Elementis*, where polyhedra are studied either as geometrical figures or as configurations of points (i.e., polyhedral numbers). It seems therefore legitimate to ask whether Descartes’ practice before 1630 was not quite different from that of the *Geometry*. If so, the allusions contained in the *Discourse* were not directed toward a first sketch of the *Geometry* but to a first encounter between algebraic analysis and geometry on which the *De Solidorum Elementis* would give us some precious evidence.

See also Beeckman, Isaac; *Discourse on Method*; *Geometry*; *Geometry*; Golius Jacob; *Method*; *Private Thoughts*; *Physico-Mathematics*

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DAVID RABOUIN

MATHESIS UNIVERSALIS

The only text in which Descartes explicitly mentions the expression *mathesis universalis* is in a passage from the *Rules for the Direction of the Mind*, where it is described as a "general science that explains everything that it is possible to inquire into concerning order and measure, without restriction to any particular subject-matter" (AT X 378, CSM I 19). The philosophical importance of this concept, the interpretation of which is rather problematic, has been appreciated only since the end of the nineteenth century, notably by Paul Natorp, then by Cassirer, Husserl, and Heidegger. By contrast, the term was understood in a mathematical sense in Descartes' lifetime, since *Principia Matheseos Universalis* is the title that Frans van Schooten – the professor of **mathematics** and intimate of Descartes – gave to one of the introductory

essays to his Latin translation of Descartes' *Geometry*. This work explains in an elementary manner the principles of the new algebraic calculus, using the literal notation and exponential sign of numerical powers, applying arithmetic operations to all sorts of **quantities**, and it is the origin of numerous mathematical works throughout the seventeenth and eighteenth centuries.

Whether Descartes' expression characterizes only the first works where he introduces a new algebra or whether it is a later innovation is still an open question. Also debated is whether *mathesis universalis* is restricted or whether it can be extended more generally and identified with Cartesian **method**. But it is certain that the expression *mathesis universalis* appears neither in Descartes' published works nor in his **correspondence**.

In keeping with received usage, Descartes employs in certain texts the term *mathesis* in the sense used in mathematical disciplines at that time, and he distinguishes those disciplines from **physics**. *Mathesis* and *mathematics* do not differ in meaning, and like the authors of the Renaissance, Descartes uses the two terms interchangeably. The sciences that composed the *mathesis* (or *quadrivium*) were traditionally divided into pure mathematics, pure *mathesis* (arithmetic and **geometry**), mixed or applied mathematics, and mixed mathematics (music, astronomy, **mechanics**, **optics**, etc.). It is in this way that Rule 8, which tackles the problem of finding the optic curve known as the "anaclastic," shows that mere competence in *mathesis* is not sufficient for discovering a proportion that depends on physics (AT X 394, CSM I 28–29). Similarly, Rule 14 leaves to the physicist the question of determining whether dimensions such as length, weight, speed, or hours have a real foundation or whether such divisions into parts are merely intellectual (AT X 448, CSM I 62–63).

In the second part of Rule 4, in adding the adjective *universalis* to the term *mathesis*, Descartes adopts an expression that appears in the *l'Apologia pro Archimede* (1597) by Adriaan van Roomen. This author develops the project of a science that unifies, insofar as it is possible, the properties and operations of the two pure disciplines, arithmetic and geometry, founding them on the fact that certain mathematical properties are common to both. For example, the fifth book of Euclid's *Elements* is as much geometry as arithmetic. According to Van Roomen, *mathesis universalis* must be to pure and applied mathematics what first **philosophy** is to physics. This *prima mathematica* concerns all "mathematical objects pure and mixed." According to Van Roomen, the most fundamental concept of *mathesis universalis* is that of proportion, common to two kinds of **quantity**, discrete and continuous. Nevertheless, the subordination of the mixed disciplines remains the same as before.

The concept that Descartes expresses in Rule 4 adopts the elements present in Van Roomen but makes decisive modifications. In effect, *mathesis universalis* is described as a science that takes not numbers and figures as its first objects but rather order and measure, independently of its application to a particular subject matter. All and only those things that are capable of order and measure are objects

of mathematics, and *mathesis universalis* is the general science of order and measure and therefore founds the whole of mathematics.

Certainly, numbers and figures (considered as surfaces rather than as parts) appear there, but so too do physical objects, for example, sounds, the stars, and all other objects: Descartes cites the two most ancient disciplines of *mathesis mixta*, but without a single limitation. According to Rules 14–21, the terms of this theory of order and measure are deployed in the representation of all dimensions, real or invented. The object of science is thus magnitude in general, as it is conceived or imagined under the form of segments and rectilinear surfaces suitable for representation by relations of order and measure. As is further shown by Rule 14, which holds that order and measure exhaust the possible relations between two things, the point of view of order precedes that of measure, because it is easier to order two elements than to measure them: measure necessarily uses a third term, whereas two suffice for order. In this way, one understands the interdependence of questions of method and those of *mathesis universalis* (which reveals the dual structure of Rule 4), since, in a general manner, the method aims to establish an order of **knowledge**.

Descartes may have abandoned the term *mathesis universalis* in the years 1630–40 because he modified his concept of pure mathematics. In the *Rules*, the two objects of pure mathematics are the two kinds of quantity, multiplicity and magnitude. When a correspondent, Joseph Ciermans, suggests in 1638 that Descartes' *Geometry* be considered as a treatise in pure mathematics, Descartes rejects this proposal because the work does not include an arithmetic or "a single question in which one considers together order and measure," but especially because the pure mathematics that he has developed has **motion** as its principal object (AT II 70–71). This passage identifies the object of traditional pure mathematics with that of *mathesis universalis* as it was conceived of in the *Rules* but, above all, makes motion the most important object of his own mathematics, which was not the case in earlier texts. The analysis of the object of *purae Matheseos* in the Sixth Meditation confirms this point of view.

See also Geometry, *Geometry*, Mathematics, Method, Motion, Physics, Quantity, *Rules for the Direction of the Mind*

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FRÉDÉRIC DE BUZON

MECHANICS

In Scholastic manuals, *natural philosophy* (**physics**) was typically defined as "the science of natural **bodies**, in so far as they are natural." This means that natural philosophy in the Peripatetic tradition did not deal with artifacts *qua* artificial. It did not share the concerns of the mechanical arts in general or of mechanics in particular. Up to and including Descartes' time, mechanics in one sense was concerned with the construction and operation of **machines** and other artifacts designed to move terrestrial things against nature (*contra naturam*) and for human ends. However, from the time of the *Mechanica*, written by a member of the Peripatetic school (Strato of Lampsacus?), and of Pappus's *Collections* (book 8), mechanics was also the theoretical discipline that dealt mathematically with problems relating to the construction and use of machines. Mechanics in this sense was often also called *the science of weights*, or *statics*. Before a mechanical device begins to act on something, there is *stasis*, a state of rest in which opposing forces are in equilibrium before being unbalanced by an external force. In statics, one calculated the relative strengths of such forces to account for states of equilibrium (equal weights on a balance) and of disequilibrium (budging a boulder with a lever). In the Renaissance, which saw the rediscovery of the *Mechanica*, mechanics became a "middle science" operating between **mathematics** and physics, in which the operations of machines were treated in a mathematical way (Laird 1986). In the Collegio Romano there arose the important question of whether this middle science could be fully integrated into the natural philosophy of the Scholastics to produce a true middle science that was not subalternated to mathematics (Wallace 1984, 202–7). The question is reflected in a professional contrast of the period: treatises on mechanics were written by mathematicians or engineers, not by philosophers within the Scholastic tradition. Not until the Newtonian eighteenth century did the question receive a positive answer, though one that was seriously qualified by considerations that cannot be addressed here.

In this setting, Descartes' *Principles of Philosophy* (1644) is a significant text. Though a major *summa* of the principles of a new kind of natural philosophy, it contains no statics and no discussion of the principles of traditional mechanics. In *Principles* II–IV, Descartes establishes **laws of nature** and shows how they can

explain *natural* phenomena, but he does not investigate the properties of machines, of artificial devices *qua* artificial. Yet he had an excellent understanding of traditional statics, as is evident from two small treatises on mechanics, one of which Descartes sent to **Constantijn Huygens** (October 5, 1637), the other to **Mersenne** (July 13, 1638) (Gabbey 1993). The first of these was in response to Huygens's desire that Descartes send him a few pages on the foundations of mechanics and the five simple machines. Huygens's expectation was that Descartes could do better in this area than Guido Ubaldo or **Galileo** (*Les mechaniques de Galilée*, translated by Mersenne in 1634). Descartes used the second treatise to illustrate the theoretical bases required to solve a problem that was debated at the time, "the geostatical question": Does a **body** weigh more or less when close to the center of the earth than when far away?

The treatise of 1637 bears the title "Explanation of machines with whose aid very heavy loads can be lifted with a small force." Descartes deals with the five simple machines: pulley, inclined plane and wedge, windlass, screw, and lever. He begins with his formulation of the traditional principle that in a mathematically refined form was later known as *the principle of virtual work* (or *virtual speeds*):

Devising all these machines rests on just one principle, which is that the same **force** [*force*] that can raise a 100-pound weight to a height of two feet, for example, can also raise a 200-pound weight to a height of one foot, or one of 400 pounds to a height of half-a-foot, and so on, as long as the force is applied to it. And this principle cannot fail to be accepted, if it is borne in mind that the effect must always be proportioned to the action necessary to produce it. (AT I 435–36, CSMK 66–67)

The same principle is stated in the shorter treatise of 1638, except that there Descartes deals with just the pulley, the inclined plane, and the lever. He emphasizes more clearly the unique importance of what he calls "le fondement general de toute la Statique" (AT II 228), which we may call Descartes' "General Statical Principle" (GSP). He warns that its strict applicability depends on *small* displacements of the bodies in equilibrium, subject to the constraints of the system (AT II 233–34, CSMK 116). This condition is of great importance. It reveals Descartes' intuitive grasp of an essential feature of the principle of virtual work. To paraphrase the first modern formulation by Johann Bernoulli in 1717, for any system of forces in equilibrium, if any of the forces suffer small displacements (*vitesse virtuelle*) from their equilibrium configurations, there is a zero algebraic sum of the *energies*, measured as force \times "virtual speed" (a small component displacement in the direction of the force).

Given Descartes' clear understanding of the theory of the five simple machines, it is puzzling that the GSP makes no appearance in the *Principles*, where he presents the three laws of nature and the rules of collision and tackles the problem of circular

motion. So why no mention of the fundamental principle of statics that governs the operations of machines? After all, in the same *Principles* (IV.203) Descartes declares that there is no difference between artifacts and natural bodies, except that the former consist of components easily available to the senses, whereas the latter consist of “organs so small that they escape all our senses.” In fact, “there are no considerations in mechanics [*Mechanica*] that do not apply also to physics [*Physica*], of which mechanics is a part or species. It is no less natural for a clock with this or that movement to tell the time, than it is for a tree grown from this or that seed to produce such and such a fruit” (AT VIIIA 326, CSM I 288). Furthermore, in the dispute with Fromondus (aka Froidmont), who had found the *Meteors* “excessively crude and mechanical,” Descartes retorted,

if my philosophy seems to him excessively crude because it considers **shapes**, sizes, and motions, as in mechanics [*Mechanica*], he is condemning what I think deserves praise above all else, and in which I take particular pride.... I am surprised he has not noticed that the mechanics that has been in use up to now is nothing other than a small part of the true physics, and which took itself off to the mathematicians, since it found no place with the supporters of the common philosophy. (AT I 420–21, CSMK 64)

In the letter to Plemp of February 15, 1638, Descartes explains that his account of the expansion of the arteries accounts for an experimental discovery of Galen’s because of “the laws of my mechanics [*Mechanica*], that is, of [my] physics [*Physica*” (AT I 524, CSMK 81). Now it is even more puzzling why the GSP does not appear somewhere in the *Principles*.

In addition to these curious features of the *Principles*, there is an apparent inconsistency in the way Descartes saw the relations between mechanics, physics, or natural philosophy, and his conception of the emerging mechanical philosophy. Mechanics figures in the simile he uses to characterize **philosophy** in the prefatory letter to the French translation (1647) of the *Principles*: “The whole of philosophy is like a tree, whose roots are **metaphysics**, the trunk physics [*la Physique*], and the branches growing from this trunk are all the other sciences, which reduce to three principal sciences, namely **medicine**, mechanics [*la Mechanique*], and moral science [*la Morale*” (AT IXB 14, CSMK I 186). Neither medicine nor moral science is a part of physics, so it seems that mechanics is not either, but is instead a disciplinary offshoot from physics and from which develop other unidentified sciences. Yet that is not entirely consistent with the claim in part IV (noted earlier) that mechanics is *a part of* physics, indeed of “the true physics” (letter for Fromondus), or with the implication that the laws of mechanics *fall within* the laws of physics. Neither is it consistent with the methodological principle, central to Descartes’ mechanical philosophy, that natural phenomena are to be explained ultimately in terms of the motion, rest,

and configuration of *res extensae* of all magnitudes. But mechanics deals with special cases of the rest, configuration, and motion of *res extensae*, so it should follow once again that mechanics is a part of physics.

These puzzles and inconsistencies did not arise from confusions or failings on Descartes' part. They are symptomatic of the difficulties, generally recognized at the time, in adapting the traditional taxonomies of mechanics to the demands of the mechanical philosophy (Berryman 2009, 236–49). The letter for Fromondus (October 3, 1637) shows that Descartes, probably aware of the debates within the Collegio Romano, regretted that mechanics had not been integrated within Peripatetic natural philosophy. Descartes' public position, as stated in *Principles* IV, was easier to state than to transform into effective rules of application, especially given the weight of tradition behind the disciplinary divide between mechanics and natural philosophy, and despite forward thinking in the Collegio Romano and elsewhere. In a letter to Huygens six months after the treatise on mechanics, Descartes regrets that *The World* is unlikely to be published for a long time and that he will not therefore be able to complete his work on mechanics, “for it depends entirely on my *World*, principally in what concerns the speed of motions. And you need to have explained what the laws of nature are, and how nature acts ordinarily, before you can really show how she can be occupied with effects to which she is unaccustomed” (AT II 50). In other words, a complete body of natural philosophy is a prerequisite for a new statics, a new theory of machines. Descartes might have explained this impasse by noting that he has been unable to follow one of his own rules from the *Rules for the Direction of the Mind*. To discover truth in the sciences, Rule 5 advocates the proper ordering of the objects of **knowledge** through the strict application of the **method** of what may be called *reduction* and *construction* (Garber 1993). Astrologers ignore this rule, or are ignorant of it; so do those who expect **truth** to spring from their heads without doing **experiments**; so do “the great number who study mechanics without physics and haphazardly contrive new devices for producing motions” (AT X 380, CSMK I 20–21). Descartes did not belong to either of these errant groups. Because of the difficulty of implementing Rule 5, and certain other *Rules*, his whole program in natural philosophy was a work-in-progress right up to the end of his life. In the prefatory letter to the *Principles*, he gives a general account of the four parts of the work, with which he believes he has “embarked on an explanation of the whole of Philosophy in an orderly way.” Then he continues: “But afterwards, to bring this plan to completion, I ought to expound in the same way the nature of each of other more particular bodies found on earth, that is, minerals, plants, animals, and principally man; and then, finally, I ought to treat with diligence [*exactement*] medicine, moral science, and mechanics [*les Mécaniques*].” (AT IXB 17, CSM I 187–8).

The structure and *topical* content of Descartes' projected *summa* of philosophy would most likely have resembled those of the *summae philosophiae* of his Scholastic

contemporaries (Gabbey 1993, 1996). It is most unlikely that it would have included the diligently treated mechanics envisioned in the preface to the *Principles*. As Descartes explained to Huygens in the letter of March 1638, his perfected mechanics depended entirely on the natural philosophy elaborated in *The World* and, we may add, in the *Principles*, published in 1644. In particular, it depended on “what concerns the speed of motions.” This veiled reference is partly due to a difficult problem that Descartes explores in the letter to Mersenne of September 12, 1638. The problem is to decide how many variables (“dimensions” is Descartes’ term) are needed to measure a body’s force. According to Descartes, the measure of the force depends on whether one dimension is involved (weight), or two dimensions (weight and distance), or three dimensions (weight, distance, and speed) (for details, see **force and determination**). Within the framework of Descartes’ mechanical philosophy, the **explanation** of the behavior of bodies falling under or rising against the force of **gravity** must be based on an account of how the forces arising from the rotation of the earth’s gravitational **vortex** determine the motions of these bodies, whether under constraint or in free fall. In turn, a causal explanation of this interplay of forces depends reductively on a comprehensive theory of collision and of vortical motion, both of which depend ultimately on the divinely grounded laws of nature. The laws of nature, the imperfect collision theory, and the beginnings of a theory of vortices, in all of which speed plays a crucial role, were central in the *Principles*, parts II and III. But Descartes was unable to develop and apply these investigations to give causal accounts of why bodies fall the way they do, or why it takes such and such a force to raise a given weight through a given distance in a given time.

The inconsistencies and anomalies mooted earlier turn out to be only apparent. Descartes’ GSP is not “a law of nature” or “a principle of physics,” in the sense of being irreducible to other than metaphysical considerations. Descartes justifies the GSP by appealing to the causal principle that “the effect must always be proportioned to the action necessary to produce it.” However, this principle, evidently cognate with the principle *nihil ex nihilo*, cannot be applied before deciding how to measure both the effect and the action that is its complete **cause**. In the case of the GSP, that decision comes only after the *empirical* discovery that the heights to which heavy bodies can be lifted by the same force are inversely proportional to their weights. The GSP is in conformity with the causal principle, but its mathematical formulation cannot be derived from it. It is a lawlike empirical rule, couched in mathematical terms, that codifies the operations of machines, simple and composite. The divinely grounded “laws of physics” are centrally the three laws of nature, as set out in the *Principles* II, and they are necessarily true of any world, created by **God**, that contains *res extensae* in motion and at rest. By contrast, the GSP just happens to be the case in this actual world of gravitational vortices that God has chosen to create. Perhaps it is ironic that the ultimate *principia* of Descartes’ perfected mechanics are not to be found in what he wrote on mechanics *qua* theory of machines, nor can

the GSP serve as a *principium* of natural philosophy to accompany the three laws of nature in the *Principles* II.

See also Cause; Conservation of Motion, Principle of; Force and Determination; Inertia; Law of Nature; Machine; Motion; Physics; Vortex

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ALAN GABBEY

MEDICINE

Attentiveness to the **anatomy and physiology** of the human **body**, and to its proper management in health and disease, is evident in many of Descartes' formal publications, and he several times states that the goal of his natural philosophy is to prolong life. Many of his closest associates in the Netherlands – where he wrote his major works – are physicians or have a medical education, including **Isaac Beeckman**, **Cornelis Van Hogelande**, **Vopiscus Fortunatus Plempius**, **Henricus Regius**, and **Henri Reneri**. Descartes is even offered a professorship of theoretical medicine at Bologna in 1633 (Manning 2013). In the mid-1640s, he acts as a medical adviser as well as philosophical interlocutor to **Princess Elisabeth**. At the same time, a version of his views presented in the medical faculty at the University of Utrecht by Regius led to the first major dispute about **Cartesianism**. His last works – the *Passions of the Soul* (1649) and the posthumous *Description of the Human Body* – confirm that

up to the last he continued to devote much effort to questions of physiology and mind-body interactions.

Descartes begins to study **animal** bodies almost from the beginning of his move to the Netherlands; they remain of interest to him throughout his life and undergird one of the chief aims of his studies, the prolongation of human life. Soon after embarking on an ambitious project “to explain all the phenomena of nature” he writes, “I am now studying chemistry and anatomy simultaneously; every day I learn something that I cannot find in any book” (AT I 137, CSMK 21). Descartes investigates the world through *expériences* (often translated as “observations” or “experiments”), and he expects his readers to do the same. In the section on human physiology in the *Treatise on Man*, Descartes explains: “I assume that if you do not already have sufficient first-hand **knowledge** of [the parts of the human body], you can get a learned anatomist to show them to you – at any rate, those which are large enough to be seen with the naked eye” (AT XI 120–21, CSM I 99). In the *Discourse on Method* (1637), he asks anyone unversed in anatomy “to take the trouble ... to have the heart of some large animal with lungs dissected before him” (AT VI 47, CSM I 134). Because he is not a physician, he relies on his medical acquaintances for human dissections, but his now missing workbook (on which **Leibniz** took notes) reports that he continues to perform anatomical studies on animals through the late 1640s.

The very purpose of his **philosophy** is, as he put it in the *Discourse*, “discovering a practical philosophy” that “would be very useful in life,” which would above all else lead to “the maintenance of health, which is undoubtedly the chief good and the foundation of all other goods in this life”; and “I have resolved to devote the rest of my life to nothing other than trying to acquire some knowledge of nature from which we may derive rules in medicine which are more reliable than those we have up to now” (AT VI 62, 78; CSM I 143, 151). In a letter of January 1638, he expressed the hope of living “more than a century” (AT I 507), and in 1639, “thirty years more” (AT II 552). In October 1645, he told the **Marquis of Newcastle** that “the preservation of health has always been the principle end of my studies” (AT IV 329, CSMK 275); nine months later he confirmed to **Hector-Pierre Chanut** that because of this, “I have spent much more time” on medical topics than on other problems, although he had not yet found ways to preserve life with certainty, so that he had decided only “not to fear death” (AT IV 441–42, CSMK 289).

The links Descartes develops between his physiological studies and medical advice are along common lines, exemplified in the famous ancient dictum to “know thyself” (*nosce teipsum*). According to this view, the only hope of living a good life in body as well as **mind** lay in regulating one’s life properly through regimen, or “dietetics,” as based on an understanding of the ordinary activities of the body. Here, the interactions between mind and body are crucial and of obvious interest to Descartes (see **human being**). The Sixth Meditation, for instance, discusses why our sensations

cause us to act against our own interests in cases of disease, while also showing that **God** is not a deceiver. In Descartes' example, when someone who is suffering from dropsy gets thirsty and drinks, worsening the condition, the **sensations** are not in error, for we truly feel thirsty. But, as in this case, sensations can be caused by bodily events that are not their ordinary causes, thus creating an error in our minds when we judge the cause incorrectly (see **error, theodicies of**). The causes of disease, by implication, are both from bodily faults and from errors in our **judgment** that originate in our bodies. Hence, the preface to the *Principles of Philosophy* (1644) announces that a proper moral philosophy would derive only from an understanding of "the nature of plants, of animals, and, above all, of man," while the "branches" emerging from the physical-science trunk of the tree of knowledge were three, one being medicine (AT IXB 14, CSM I 186). He comments elsewhere in that work that he had not had enough time to complete his studies on **animals**, plants, and the human body, causing him to simply add a few last observations "concerning the objects of the senses" (AT IXB 310, CSM I 279).

Descartes' anatomical and physiological views stress the materialist interactions of all the structural parts of the body, emphasizing the importance of the **heart** and of the blood and its circulation, which he explained in materialist chemical terms. Some of his medical readers were excited about the possibility of giving an account of all the activities necessary for generation, growth, and nutrition without resort to such putative entities as **animal spirits** or humors. One of them, his friend and self-professed "disciple," **Henricus Regius**, reinterpreted Descartes' physiology and pushed it toward monist materialism, which led to the Utrecht Affair beginning in 1641 (see **Voetius, Gysbertus**).

But Descartes' conversations with Princess Elisabeth pushed him to some new conclusions about how good health depends on following the expressions of the body, which were formulated in his last treatise, *Passions of the Soul*. By 1644, the young Elisabeth was fondly referring to Descartes as her doctor. But she was not well, and she had decided on a course of diet and exercise that Descartes approved. He wrote that "there is no doubt that the soul has great power over the body, as is shown by the great bodily changes produced by anger, fear and other **passions**" (AT V 65, CSMK 237). (She later described her illness as due to "a long oppression of the heart from sadness," which caused a "slow fever"; and again as a "melancholie" causing a bodily illness and weakness of spirit [AT IV 208, 233].) He was eager to have her follow his own example and manage her mind in such a way that would improve her health. But Elisabeth objected that many people, including those who are ill, do not have the free use of their **reason**. She went on to ask Descartes to give "a **definition** of the passions, in order to make them well known" (AT IV 289). As before, he approached the problem physiologically. By early 1646, Descartes had drafted a work on the passions, which he sent to Elisabeth for her comment. In writing to her about his new ideas, Descartes focused on the heart and

the movements of the blood that accompany each passion, which were grounded in physical and physiological movements, and that “the remedies against excessive passions are difficult to practice” and “insufficient to prevent bodily disorders.” He still believes that mental exercises might free the soul of being dominated by the passions and so enable its “free judgment.” But now he declares that “it is only desires for evil or superfluous things that need controlling,” which, as an explicit endorsement of the passions, breaks with traditional medical advice. More striking still, he writes, “it is better to be guided by experience in these matters than by reason” (AT IV 407–12, CSMK 285–88).

In November 1649, the final version of his *Passions of the Soul* appeared in print. It argued that the passions are the source of all goods in life: they are all good, and all the pleasures that are common to both soul and body, such as love, “depend entirely on the passions” (AT XI 488, CSM I 404). Much of the treatise on the passions is therefore focused on how the passions and bodily physiology are intertwined, especially due to the involuntary motions of the blood caused by the passions, which could lead to putrefaction of the blood and hence fevers; movements of the blood clearly remained the groundwork of his physiology. Descartes concludes, then, not that we should arrange our passions to be in accord with our reason, but that we should arrange our minds to desire what our natures wish us to desire. If we do so, we can compose our volition to act in accordance with what is good and healthful for us. Up to the very end, then, the hope of finding a method to maintain health and prolong life by living well – the classical goal of medicine – which in Descartes’ view meant living in accordance with our natures, remains one of his chief aims.

See also *Anatomy and Physiology*; Elisabeth, Princess of Bohemia; Happiness; Heart; Human Being; Passion; *Passions of the Soul*

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HAROLD COOK

MEDITATIONS ON FIRST PHILOSOPHY

Meditationes de Prima Philosophia is widely recognized as Descartes' most important work, and a watershed book in the history of Western philosophy. Before Descartes' *Meditations*, philosophers asked, What must the world be like so that we find it intelligible? Afterward, they tended to ask, What must the **mind** be like in order for the world to be intelligible to it? The nature of awareness itself, independent of any particular object of awareness, became an issue for **philosophy**. Descartes' own aims in the *Meditations* were to demonstrate the **existence** and transcendence of **God**, as well as the distinctness of **body** and soul, and to show that the best way to investigate nature is via a geometrical **method** that subordinates and defers the records of sense, in order to best exhibit their meaning. The emergence of human consciousness as a topic stems from the second aim and its introduction via **doubt** and reflection in the first two *Meditations*.

The argument of the *Meditations* is given very briefly in part 4 of the *Discourse on Method*. Descartes circulated his new, expanded presentation first to two Dutch colleagues, who showed it to **Johannes Caterus**; the first set of "Objections," to which Descartes wrote "Replies," are thus from Caterus. Descartes sent the text and the first set of the *Objections and Replies* to his friend and agent in Paris, **Marin Mersenne**, who circulated them to various philosophers and **Jesuits**, including **Morin**, **Hobbes**, **Arnauld**, **Gassendi**, and **Bourdin**. The first edition of the *Meditations* was published

in Paris in 1641, with six sets of *Objections and Replies* appended; a seventh set was added for the second edition published in Amsterdam in 1642.

There are six meditations; the reader is supposed to accompany Descartes as he moves through them, a reenactment and set of cognitive exercises modeled after the spiritual exercises of Saint Ignatius Loyola. The aim of these exercises is for the meditator to discover the **truth** for herself. In the First Meditation, Descartes offers a series of skeptical arguments in order to set aside every received truth, as a way of beginning the search for truth unencumbered by the errors of the past. The final stage, hyperbolic doubt, leaves as its only residue a first-person assertion of pure self-consciousness: “I am [*sum*], I think [*cogito*].” In the Second Meditation, the self sorts out its (so far merely) subjective certainty by a series of distinctions, first among them the distinction between the mind and body, for it can only know itself as essentially the activity of **thought**. Excluding the testimony of **sensation**, the *cogito* fixes on **mathematics** as the condition of objective **knowledge**, should objective knowledge eventually prove possible. In the Third Meditation, the self discovers among its **ideas** the infinite idea of God. Here Descartes’ intuitionism becomes apparent: the true is the evident, the clear and distinct, the compulsion of assent; moreover, the self can only produce ideas that are proportional to itself. Yet the idea of God is undeniable. Thus, the self has secured an external object, and that object secures the criterion of evidence and with it the method of the order of reasons (knowledge can be organized as a chain of items, where the first are simple and evident, known without the aid of those that follow, and where those that follow are shown to be true solely on the basis of those that precede) (see **analysis versus synthesis**). In the Fourth and Fifth Meditations, Descartes shows how God as an object of knowledge secures the method, and how the method supports the idea of God; in so doing, he revisits mathematics and finds it not only an objective source of knowledge but, in the Sixth Meditation, the key to knowledge of the material world.

During the past seventy-five years, there have been many scholarly disputes over the nature and direction of the philosophical rivers that the *Meditations* divides. Mid-twentieth-century Anglophone philosophers like A. J. Ayer, Bernard Williams, Harry Frankfurt, Margaret Wilson, Edwin Curley, and Jaakko Hintikka (collected in Doney 1967) found in the *Meditations* a set of epistemological problems. What is the logical status of the *cogito*? Are the arguments for the trustworthiness of the criterion of clarity and distinctness circular? (See **Circle, Cartesian**.) Is Descartes’ main goal to defeat skepticism? Is the Cartesian knower trapped behind the “veil of ideas”? What are the logical frailties of Descartes’ proofs of the existence of God? (Cf. Curley 1978, Williams 1978, and Margaret Wilson 1978.) More recent books also pursue and contest this epistemological tradition (e.g., Catherine Wilson 2003, Cottingham 2008, and Cunning 2010).

The new generation of scholars writing on the *Meditations* has, however, benefited from the influence of broader traditions. In part because of cultural

bridge building by various scholars (see, e.g., Ariew, Armogathe, Beyssade, Grene, Garber, Gaukroger, and Marion), the contributions of French scholarship have been integrated into the Anglophone discussion. Martial Gueroult's (1984 [1952]) two-volume treatment of the *Meditations* was especially influential. Greater receptiveness to European studies led, on the one hand, to a series of books about Descartes in relation to his neo-Scholastic forebears and contemporaries, addressing the relation between Descartes' project, **metaphysics**, and theology (e.g., Ariew 1999, Des Chene 1996, and Marion 2007). On the other hand, it led to books about the *Meditations* in relation to the rise of early modern science (e.g., Garber 2001, Hatfield 2002, and Machamer and McGuire 2010). These books remind us that the Sixth Meditation paves the way for the *Principles of Philosophy*, Descartes' treatise on **physics**, so influential in its time that **Newton** named his great book *Mathematical Principles of Natural Philosophy* to signal that he intended to supplant Descartes. The broad range of current scholarly approaches to the *Meditations* is now well represented in recent anthologies (Broughton and Carrierio 2008, Cuning 2014, and Gaukroger 2006).

In the *Meditations*, Descartes argued that sense perception is a subordinate modality of awareness, subordinate to rational intuition whose objects are God, the soul, mathematics, and those features of nature that can be expressed mathematically. On that basis he defended the existence of a transcendent God against skeptics and nonbelievers, promoted a novel theory of the relation between soul and body that introduced human awareness as a philosophical problem in its own right, and helped inaugurate a new science informed by mathematics. Thus too Descartes' great book opened up the possibility of radical idealism and radical materialism, experiments in metaphysics from which contemporary philosophy still has not recovered.

See also Analysis versus Synthesis; Body; Circle, Cartesian; Certainty; Clarity and Distinctness; *Cogito Ergo Sum*; Cosmological Argument; Doubt; God; Knowledge; Metaphysics; Method; Mind; *Objections and Replies*; Ontological Argument; Sensation; Truth; Wax

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EMILY GROSHOLZ

MEMORY

Descartes thought about memory in the distinct contexts of **method**, **metaphysics**, **medicine**, mortality, and morals. Keenly aware of the fallibility and instability of natural corporeal memory, he considered various ways to bypass it or avoid relying on it, but he also came to see its importance in understanding and dealing with the **passions** and the union of **mind** and **body** (see **human being**). His account of memory influenced **Malebranche** and associationist traditions but was subject to sharp attack from critics who saw it as dangerously materialist and chaotic.

In the *Rules*, Descartes worries that the **intellect** must rely on memory to connect the steps in a reasoning process. But “since memory is weak and unstable, it must be refreshed and strengthened” by a continuous and repeated “movement of **thought**,” until the thinker can intuit the whole series of operations, passing over them all “so quickly that memory is left with practically no role to play” (AT X 409, CSM I 38) (see **deduction**). Descartes was not attracted to artificial memory techniques, turning instead to **anatomy and physiology** to “explain what **imagination**, memory, etc. consist in” (AT I 263, CSMK 40). In the *Treatise on Man*, Descartes writes that “the effect of memory that seems to me to be most worthy of consideration here is that, without there being any soul present in this **machine**, it can naturally be disposed to imitate all the movements” of real humans (AT XI 15, G 157). So there is genuine memory in soul-less bodies: Descartes is consistent in attributing memory to **animals** (AT IV 310, CSMK 270).

Corporeal **ideas** are figures traced by **animal spirits** on the surface of the **pineal gland**. These occurrent impressions then leave traces “on the internal part of the brain ... which is the seat of memory” (AT XI 176–77, CSM I 106; H 86–87; G 149–50). Flowing through the gaps between the tiny fibers of the brain, the spirits enlarge or alter these pores, continually bending and rearranging the fibers and tubes. When the movement of the spirits is stronger, long-lasting, or often repeated, these patterns “are retained there in such a way that by means of them the ideas that existed previously on this gland can be formed again long afterward, without requiring the presence of the objects to which they correspond. And it is in this that *Memory* consists” (AT XI 178, CSM I 107; G 150). In this account, all but repeated in the *Passions of the Soul* (AT XI 360, CSM I 344), remembering is the reconstruction of a patterned **motion**, not the retrieval of a discrete body. The internal dynamics of brain and body, and the array of factors influencing the state of the animal spirits, introduce causal complexity into the process, even without input from the soul or the external world (see **cause**). It “usually happens that several different figures are traced in the same region of the brain,” so that “the spirits will acquire a [combined] impression of them all.” This explains both imaginative fantasies and why “past things sometimes return to thought as if by chance” (AT XI 184–85, G 156).

Descartes was aware that this account brought memory and imagination uncomfortably close. Critics complained that our memories would thus be “stored with infinite variety of divers, yea contrary motions, which must needs interfere, thwart, and obstruct one another: and there would be nothing within us, but ataxy and disorder” (Glanvill 1661, 39). But Descartes had solved the puzzle of finding room in the brain for all a person’s memories, which exercised him in the *Rules* (AT X 415, CSM I 41–42): there need not be a large number of “folds” in the brain “to supply all the things we remember, because a single fold will do for all the things which resemble each other” (AT III 143, CSMK 151). On this dynamic distributed model of corporeal memory, many enduring traces are layered or superposed in the same physical resources. Animals or **automata** without a soul, and humans when the soul is elsewhere, are capable of complex learning and experience-dependent interaction with their world (Sutton 1998, 74–93).

In other contexts, however, Descartes also invoked an incorporeal memory of **universals**, assuring **Burman** that “I do not refuse to admit intellectual memory: it does exist” (AT V 150, CSMK 336), and depends on traces “in the mind itself.” Its objects are “purely intellectual things,” and it does not retain particulars or any special connection to the past: so “memory in the strict sense is not involved” (AT V 150, CSMK 337; AT III 425, CSMK 190; AT IV 114, CSMK 233). Nonetheless, Descartes tells the bereaved **Huygens** that even after death “we shall still remember the past” by way of this “intellectual memory which is certainly independent of the body” (AT III 598, CSMK 216). The relations between the “two different powers of memory” (AT V 192, CSMK 354) remain unresolved, and Descartes’ focus stayed

with corporeal memory in the *Passions of the Soul* (1649), the last work published in his lifetime.

It is due to experience and memory, as much as biology, that “all brains are not disposed in the same manner” (AT XI 358, CSM I 343). Therefore, memory underpins the more effective, though difficult, “remedy” for the passions that Descartes considers. When our soul is united with our body-machine, we can come to understand the mechanisms of association that link particular physical movements with thoughts and passions. Considering examples of the complex alterations wrought by experience on body and brain, Descartes suggests that we can, within limits, control the passions through new habituation (Sutton 2000, Hatfield 2007) (see **habit**). Descartes did not argue that we should root out and challenge every memory or prereflective idea: there can be no total epistemological reevaluation, no wholesale destruction of the fabric of belief, because of the holistic nature of memory storage in the patterned motions of animal spirits through the pores of the brain.

See also Anatomy and Physiology; Animal Spirits; Automaton; Dualism; Habit; Human Being; Imagination; Machine; Mind; Passion; *Passions of the Soul*; Pineal Gland; Soul, Immortality of; *Treatise on Man*

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JOHN SUTTON

MERSENNE, MARIN (1588–1648)

Mersenne is perhaps best known as Descartes' principal correspondent during the latter's residence in the Netherlands from 1629 until Mersenne's death. He assisted in the publication of Descartes' *Discourse on Method* in 1637 and gathered the Objections to the *Meditationes* (1641). Mersenne also corresponded prodigiously with many other philosophers throughout Europe, acting as intelligencer and clearinghouse, communicating ideas and mediating disputes.

Mersenne was educated by the **Jesuits**, entering the newly founded Jesuit College of La Flèche in 1604, where he was an older contemporary of Descartes. Mersenne left La Flèche in about 1609 to study theology in Paris, at both the Sorbonne and the Collège de France. In 1611 he entered the Order of Minims, joining its Parisian convent off the Place Royale (now Place des Vosges) in 1619 and living there for the rest of his life.

Mersenne numbered Protestants as well as Catholics among his correspondents and strove to overcome their doctrinal divisions. Unlike his early, published assaults on heresy, this generally took the form of promoting a moderate, reconciliatory form of Catholicism. He never changed his perception of the dangers of skepticism, however, and his so-called mitigated skepticism amounted to a philosophical irenicism to match the religious.

Mersenne's engagement with the work of his philosophical contemporaries extended well beyond Descartes' writings. During the 1630s, Mersenne promoted

the work of **Galileo**; met and corresponded with **Isaac Beeckman**; and brought back to France from Italy in 1645 knowledge of the Torricellian barometric experiment, which led to **Blaise Pascal**'s celebrated work on the weight of the air.

Mersenne early confronted Pyrrhonian skepticism. By the mid-1620s he had come to see it as just one example of a whole range of philosophical positions that threatened religious and social stability. The most common tactic of its opponents in France at this time was to counter Pyrrhonian arguments piecemeal, but Mersenne attacked Pyrrhonism by developing an epistemology to act as a bulwark against skepticism. Mersenne's interest in natural philosophy and in the mathematical sciences contributed to this approach.

For Mersenne, the problem with Pyrrhonism was not so much its use of skeptical arguments as the radical nature of the **doubt** that those arguments aimed to produce; profound and generalized doubt came too close to promoting doubt in religion. Mersenne attempted to establish bridgeheads of certain **knowledge**, in the hope that these would indicate a workable foundation for rational theology and a rational, enforceable social order.

The main such bridgehead was that of the mathematical sciences. He had used the mathematical science of **optics** in *Quaestiones in Genesim* (1623) to show the impossibility of naturalistic **explanations** of certain miracles. Mersenne's Jesuit education had stressed the **certainty** of **mathematics** as a contrast to the merely probable knowledge available from qualitative Aristotelian **physics**. Mersenne's stance in *La vérité des sciences* (1625) flows directly from this form of humanist probabilism. He does not absolutely reject any kind of knowledge that lacks absolute certainty; instead, he tends to discount it only to the extent that it fails to serve his anti-Pyrrhonian argumentative strategy. By dismissing anything accepted as uncertain, he concentrates on the opportunities presented by what *is* certain; in practice, this usually means mathematics, together with ordinary sense **perception** and syllogistic logic (see **syllogism**).

Mersenne opposed to Pyrrhonism the Ciceronian humanist probabilism widely promulgated in the schools, including the Jesuit colleges, and emphasized the kinds of knowledge that this position typically allowed as certain. He therefore abandoned the unattainable essentialism of Aristotelian natural philosophy, even while describing it as the "most probable" such system. In its stead, he upheld the mathematical sciences as the models for a new science of nature based on different expectations. Mersenne should not, therefore, be seen as substituting a new philosophy in place of Aristotelianism as his answer to the Pyrrhonist threat, in the manner of Descartes.

Mersenne's later work, as both correspondent and author, focused on the mathematical sciences. Following Robert Lenoble's classic study *Mersenne ou la naissance du mécanisme* (1971 [1943]), he is sometimes called a "mechanist." Lenoble's use of the term "mechanism" equates it with instrumentalist, operational knowledge, whereas the usual meaning nowadays among historians relates to specific *ontological*

commitments, chief among them corpuscularianism or atomism. These stances, associated most closely with Descartes and **Gassendi** respectively, are essentialist, in that they make commitments to views on the underlying natures of things. For Descartes, the commitment is meant to be dogmatic rather than conjectural; for Gassendi, it is explicitly hypothetical. But neither stance appealed to Mersenne. The model of the mixed mathematical sciences provided the perfect *via media*, since they seemed to offer certainty without requiring specific ontological commitments.

Mersenne's first publication on the mathematical sciences was *Synopsis mathematica* (1626), a compendium of material on **geometry**, optics, and **mechanics**, which appeared in a second edition in 1644 under the title *Universae geometriae ... synopsis*. In 1634 he published *Les mechaniques de Galilée*, a French paraphrase of an early Galilean work from the turn of the century on statics and the simple **machines**, previously circulated only in manuscript; *Les nouvelles pensées de Galilée* followed in 1638–39, presenting paraphrased material from Galileo's 1638 *Discourses and Demonstrations concerning Two New Sciences*.

Mersenne also published extensively on music, another mathematical science. The first, in 1627, was the *Traité de l'harmonie universelle*, following which Mersenne began work on the multivolume *Harmonie universelle* (1636–37). Music as a branch of mixed mathematics is concerned with ratios and proportions that are associated with certain privileged qualitative features of the world; it thus serves to express the ineffable with mathematical precision – hence Mersenne's Augustinian conception of what he calls “universal harmony.” Musical consonances themselves are treated as the result of the relative frequencies of series of air pulses; in taking these latter as tantamount to sound itself, he went beyond the usual treatment, which only *correlated* sound with mathematizable air disturbances, instead of *identifying* sound with them. Mersenne's mathematical pragmatism thus retained a form of Platonic essentialism in his approach to physical phenomena.

See also Galilei, Galileo; Jesuits; Mathematics; *Objections and Replies*; Pascal, Blaise

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PETER DEAR

MESLAND, DENIS (1615–1672)

Mesland was born at Orléans and died at Santa Fe, Bogotá. He was a **Jesuit**, becoming a novitiate in Paris and studying rhetoric there, 1630–33. He then took the course in philosophy, 1633–36, at the Collège Henri IV, the Jesuit school in La Flèche Descartes had attended; he taught letters and studied theology there, 1636–46. His **correspondence** with Descartes began in 1644, after he informed Descartes that he wrote an abridgment of the *Meditations* in a form that would be fit for teaching students at a Jesuit college. Descartes was delighted, believing that the paraphrase would be effective for getting it approved (AT IV 122, CSMK 236). The correspondence ended in 1645, when Mesland left La Flèche to become a missionary in the New World.

The Mesland correspondence directly addresses the theologically sensitive topic of the nature of human freedom: whether our freedom of action involves an “indifference” that allows our will to act otherwise than it does. Jesuits insisted that such indifference is needed to ward off the Calvinist doctrine of predestination, and others argued that it would compromise the Augustinian doctrine that meritorious action follows from God’s irresistible grace. Descartes seems to have favored different sides at different times. Early on he stated that his account of freedom agreed perfectly with the one written by the Sorbonne Oratorian **Guillaume Gibieuf** (AT I 153, CSMK 26). He insisted in the Fourth Meditation that “the

indifference I experience when there is no reason moving me more in one direction than in another is the lowest grade of freedom,” and that our will is most free when it is led to embrace the true and the good either by clear and distinct perception or by divine grace (AT VII 57–58, CSM II 40). However, in a 1644 letter, presumably to Mesland, Descartes claimed that there is only “a verbal difference” between Mesland’s position and his own since, according to him, our free action involves “a real and positive power to determine” that action (AT IV 116, CSMK 234). He also noted that he could see no great difference between his views and those of the Jesuit **Denis Petau**, who wrote a critique of Cornelius Jansenius’s account of freedom (see **Jansenism**). In 1645 Descartes repeated that one can identify indifference not only with a balance of reasons but also with “a positive **faculty** of determining oneself to one or the other of two contraries, that is to say, to pursue or avoid.” He concluded that our free action always involves such a power, since “absolutely speaking” we can do the contrary of what we freely do “provided we consider it a good thing to demonstrate the freedom of our will by so doing” (AT IV 173, CSMK 245) (see **free will**).

The issue of **transubstantiation** was also central to Descartes’ relations with the Jesuits. It was brought to the fore in **Antoine Arnauld**’s Fourth Objections. But even before his response to Arnauld, Descartes had boldly asserted in a letter to a Jesuit that his naturalistic **explanations** were consistent with the mysteries of the Catholic faith and that his **metaphysics** and **physics** were compatible with Catholic revealed theology, including the mystery of the Eucharist (AT I 564, CSMK 88). Arnauld’s original objection was that transubstantiation requires the accidents of the bread to remain after the **substance** of the bread is taken away. According to Arnauld, this would not be possible in Cartesian **philosophy**, since for Descartes there are no real accidents but only **modes** of substance, which are unintelligible apart from the substance in which they inhere. Descartes accepted this characterization of his position, except that he denied ever having rejected real accidents and affirmed that **God** can bring about things we are incapable of understanding. But he then went on to sketch an account of how objects affect the senses by means of their surface or the surrounding air or other bodies. Descartes hypothesized that if the substance of the bread is changed into the substance of something else but still occupies the boundaries occupied by the previous substance, the new substance would affect our senses in the same way the old one did. However, this response says nothing about the real presence of Christ in the consecrated bread. Descartes provided a further explanation in a letter to Mesland, sketching an account of **individuation** for bodies and the human **body** (AT IV 167, CSMK 243). There, Descartes accounted for the miracle of transubstantiation by having the soul of Christ supernaturally inform the matter of the host upon consecration.

See also Calvinism, Free Will, Individuation, Jansenism, Jesuit, Transubstantiation

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ROGER ARIEW

METAPHYSICS

Descartes presents his reader with many faces, among them that of an epistemologist, a mathematician, a physicist, and a physiologist, but he is best known for his distinctive metaphysical claims – for example, that he exists as a purely thinking thing, that **mind** and **body** are really distinct, that mind and body causally interact, and that **God** or a supremely perfect creator exists. But perceptions of Descartes' legacy have changed repeatedly over the centuries, and the fact that he is known now primarily as a metaphysician is more reflective of us, his twenty-first-century readers, than of his own preoccupations. Recent scholarship has revealed that Descartes sees himself mainly as a scientist (or natural philosopher) who spends much of his time experimenting, studying the experiments of others, and theorizing about the results (see, e.g., Gaukroger 1995, Clarke 2006). This is in keeping with his professed view that metaphysics is something one does “once in a lifetime” (*semel in vita*) and that the bulk of one's intellectual life should be devoted to pursuits such as **mechanics**, **medicine**, and morality, which yield practical benefits for humankind (AT IXB 14, CSM I 186; cf. AT III 695, CSMK 228 and AT V 165). Still, Descartes believes that metaphysics is important and necessary insofar as it provides a foundation for science, and this belief is reflected in the number of pages he devotes to it in his two most important works, the *Meditations* and the *Principles*.

Descartes uses the term “metaphysics” (Latin *metaphysica*, French *métaphysique*) and its cognates infrequently in his writings, raising questions in at least one commentator's mind about whether “Cartesian thought belong[s] to metaphysics” as that term was traditionally understood by his predecessors (Marion 1999, 1–2). In his **correspondence**, Descartes refers to drafts of the *Meditations* as his “*Metaphysics*,” but he ultimately settles on the title *Meditations on First Philosophy* “because I do not confine my discussion to God and the soul, but deal in general with all the first things to be discovered by philosophizing” (AT III 235, CSMK 157). Here Descartes is assuming the Thomistic account of *special* metaphysics (as opposed to general metaphysics) as the science of immaterial beings, but in what follows we will use the term

“metaphysics” in its broader contemporary sense, which seems very close to what he means by “first philosophy.”

One way to frame a general discussion of Cartesian metaphysics is by addressing two questions, the first of which has been the subject of intense debate over the past thirty years:

1. To what degree is it original or even revolutionary?
2. To what degree is it systematic?

The remainder of this entry is dedicated to each of these questions and is divided accordingly.

1. THE INNOVATIVE CHARACTER OF CARTESIAN METAPHYSICS

Descartes offers conflicting answers to the originality question. In some places, he proudly trumpets the revolutionary character of his philosophy. For example, in his autobiographical sketch in the *Discourse on Method*, he describes himself as reforming all of human learning by beginning from a clean slate and using only his reason as a guide to the truth. He must start anew since what he learned from his teachers at La Flèche and from reading classic books only inflamed his doubts: “Nothing solid could ... [be] built on such shaky foundations” (AT V 4–14, CSM I 112–17). But in other places he downplays his originality. For example, in the preface to the *Principles* he says that the first principles of metaphysics “have been known for all time and indeed accepted as true and indubitable by everyone” (AT VIIIA 10, CSM I 184). On the basis of such contradictory remarks, John Cottingham (2008, 55–56) concludes that Descartes does not much care about originality, that in making these pronouncements he is solely concerned with gaining a sympathetic audience for his ideas. When it serves his interests, he is happy to “propagandize” for their innovative character, but when he wishes to avoid offending the Catholic Church, which officially prohibited teachings that deviated from Aristotle, he champions his commitment to tradition.

Leaving rhetoric aside, Cottingham (2008, 56) holds that Descartes is indeed an innovator but his innovations are confined largely to science. With respect to metaphysics, Descartes is content to borrow heavily from Aristotelian **Scholasticism** and Neoplatonism. Cottingham (2008, 68–70) cites as examples the controversial causal principles that Descartes invokes in developing the **cosmological argument** for God’s **existence** in the Third Meditation, as well as his commitment to the notion of **substance**. The problem is that this “residual metaphysical lumber” leaves an

unresolved tension in Descartes' philosophy. As a result of his foundationalism, he tries to graft a new mechanistic picture of the universe "onto something like a traditional metaphysical undercarriage," but it is not a good fit. The notion of substance in particular has its home in Aristotelian Scholasticism, which envisages a world of discrete, enduring objects, each defined by its essential **attribute**. By contrast, the new mechanistic science describes a world of microscopic particles that are in constant flux and whose behavior can be understood in purely quantitative terms, and thus "where substances and attributes play no ... role" (Cottingham 2008, 11–12). Given his scientific outlook, Descartes could have dispensed with the twin notions of substances and attributes, and with the traditional model of causation, but since he failed to do so his revolution in philosophy is incomplete (Cottingham 2008, 71–74).

Cottingham's analysis is rich and complex and thus offers several claims to assess. The first assertion, that Descartes' professions of novelty are merely rhetorical or opportunistic, is belied by remarks in private correspondence where his sincerity is clear. Most notably, in an oft-cited letter to **Mersenne** about the *Meditations*, he writes: "Between ourselves ... these six Meditations contain all the [metaphysical] foundations of my **physics**. But please do not tell people, for that might make it harder for supporters of Aristotle to approve them. I hope that readers will gradually get used to my principles, and recognize their **truth**, before they notice that they destroy the principles of Aristotle" (AT III 298, CSMK 173). This remark in the context in which it appears shows that Descartes did in fact see his metaphysics as revolutionary, even if sometimes he had to downplay or conceal this fact to win support from those who, fearing the Inquisition, were allergic to novel opinions. Elsewhere, he says that while innovation is to be condemned in matters of religion, "there is nothing more praiseworthy" in philosophy (broadly construed) (AT VIII B 26, CSMK 221). Here he is responding to **Voetius**'s criticism of the innovative character of his metaphysics.

Cottingham is not the only commentator to hold that Descartes' metaphysics borrows much from medieval philosophy, especially Scholasticism. Several scholars have argued that various Cartesian doctrines, especially the more recondite ones, are best interpreted in light of the work of such philosophers as **Augustine**, **Aquinas**, **Scotus**, **Ockham**, and **Suàrez**, or their followers. Some of the issues in question include the status of the **human being** (Hoffman 1986), the nature of objective being (Cronin 1966, Gilson 1930, Normore 1986), the status of **eternal truths** (Rozemond 2008), the theory of **distinctions** (Gilson 1913), and the nature of a **cause** (Schmaltz 2008) (cf. Ariew 2011, Carriero 2009, Menn 1998, and Secada 2000). Among some commentators, this way of understanding Descartes has the status of a general interpretive principle, but few would go so far. One thing no one would deny is that Descartes often deploys the terminology of his Scholastic predecessors, but this still leaves open the questions of what this shows and why he does so. Is he, as the French scholar Émile Boutroux asked about a century ago, pouring

new wine into the old bottles of Scholastic vocabulary, or is he genuinely committed to their doctrines? If the former, then Descartes is using his opponents' terminology as a Trojan horse for his own views. If the latter, then he is not "the father of modern philosophy" after all but "the last of the Scholastics." The answer likely falls in between these two extremes, but the following considerations strongly suggest that the former is closer to the truth.

Descartes often heavily adapts traditional doctrines to satisfy his own philosophical intuitions. It is well known that Descartes banishes many of the metaphysical entities that Aristotle and his Scholastic followers ascribed to material substances – for example, **substantial forms**, **real qualities**, faculties, propria, and powers – on the grounds that they are occult and explanatorily vacuous. This is one of the ways in which Cartesian metaphysics is innovative, but it is innovative not just in what it denies but also in what it affirms. Where the Scholastics see substances as the subjects of various forms of composition (e.g., matter and form, **substantial form** and accidental forms, act and potency), Descartes conceives of them as (relatively) simple, ontologically speaking. For example, although Descartes speaks in the traditional way of "essences" or "essential attributes," he holds that a substance and its **essence** are merely rationally distinct, which is to say that they are identical in reality. This means that a corporeal substance *just is* its **extension** and a finite mental substance *just is* its thinking. Moreover, what is true of a substance's essence or "principal attribute" is also true of its "generic" attributes, such as duration and existence (AT VIIIA 30, CSM I 214–15; Nolan 1997). It is sometimes noted that even what Descartes terms "**modes**" bear a very intimate connection to substances. As ways of being an extended or thinking thing, modes are not merely tacked on like Aristotelian accidents but express a substance's essence (Garber 1992, 69).

In addition to reconceiving the relation between a substance and its affections, Descartes revolutionizes the notion of substance itself. Here it is important to see that, for him, this notion is not one of our first or most basic metaphysical intuitions but is abstracted from them. The *Meditations* provides the correct picture. There, the meditator devotes much effort to forming clear and distinct ideas of his own mind, body (i.e., the whole of the physical universe), and God, but not the general idea of substance. The former then are our most basic or primitive ideas. Once we have these, then we can produce a general idea of finite substance, but as Descartes indicates in the *Principles*, this is difficult to form:

It is much easier for us to have an understanding of extended substance or thinking substance than it is for us to understand substance on its own, leaving out the fact that it thinks or is extended. For we have some difficulty in abstracting the notion of substance from the notions of thought and extension. (AT VIIIA 31, CSM I 215)

So, once one has a clear and distinct idea of one's own mind and body, then one can, by performing an intellectual abstraction, form an idea of finite substance in general (cf. Nelson 2014) (see **abstraction versus exclusion**). But these remarks indicate that that idea either is not clear and distinct or is so only fleetingly. The important point is that the ideas of particular substances are prior to our idea of (finite) substance in general (Nolan forthcoming).

On Descartes' view, one cannot form an idea of substance that is so general that it applies to both created substances and God, for God is *sui generis*. So he offers two different **definitions** of substance:

1. God or infinite substance is something that does not depend for its being on any other thing.
2. Finite substance is something that does not depend for its being on anything else *except* God or infinite substance. (AT VIIIa 24, CSM 210)

These definitions are very thin, employing only the notion of ontological independence. By defining substances in this way, Descartes makes indirect contact with one of Aristotle's many characterizations (see Woolhouse 1993, 16), but his definitions reflect his own distinctive metaphysical concerns. The notion of independent existence is crucial to the proof of real **distinction** between mind and body that underwrites Cartesian **dualism**. Minds and bodies are really distinct because they can exist apart from each other and from anything else other than God. His definitions also stress the important theological gap between God and created things and the fact that the latter depend for their existence on God. One might say that the Cartesian concept of substance is a construct that is calculated to satisfy an audience steeped in Scholastic Aristotelianism but which subtly overturns traditional doctrine. Could he have dispensed with this concept entirely? Perhaps, especially if he were writing one hundred years later, but he is trying to convince his contemporaries of his revolutionary ideas using the traditional terms of debate, with the hope of breaking down their resistances before they have a chance to appreciate how novel his views really are.

2. THE SYSTEMATIC CHARACTER OF DESCARTES' METAPHYSICS

The early modern rationalists are famous for having devised bold metaphysical theories that are elegant and highly systematic and that challenge our commonsense understanding of the world. One thinks especially of **Spinoza** and **Leibniz**, with their elaborate systems spun from a few fundamental **axioms** such as the principle of sufficient reason. Is Descartes a "system builder" like them? The following

considerations might lead one to think not. First, he never writes a sustained treatise on metaphysics (contrast Spinoza's *Ethics*). He privately refers to the *Meditations* as his "Metaphysics," but that work focuses on epistemological questions and does not reveal the relation between his metaphysical views. It also omits some of his most important doctrines, leaving to his reader the task of piecing together his remarks about metaphysical questions from various writings, including his **correspondence**, which would not have been available to his contemporaries during his lifetime. Second, some of his doctrines, such as the claim that the **eternal truths** are created by God, seem bizarre and unmotivated. How could that be part of a deeply integrated system? Third, Descartes seems uninterested in certain traditional metaphysical topics – such as the problem of **individuation**, which so enthralled his Scholastic predecessors – and gives other topics, such as the nature of a **cause** and of **time**, short shrift. One also wishes he had said more about the nature of mind-body interaction, the status of the **human being** (or mind-body union), and the nature of **free will**.

But Descartes believes that his metaphysics does hang together in a coherent fashion. He writes:

My thoughts are so interconnected that I dare to hope that people will find my principles, once they have become familiar by frequent study and are considered all together, are as well proved by the consequences I derive from them as the borrowed nature of the moon's light is proved by its waxing and waning.
(AT I 564, CSMK 88)

"Systematicity" can of course have different meanings; Descartes indicates here the two most salient ones – interconnectedness (*liaison*; his thoughts are literally "bound together") and fecundity or richness of consequences.

The best way to appreciate the systematic character of Descartes' metaphysics is by regarding the clear and distinct ideas of mind, body, and God as first principles, from which various consequences follow (cf. Nelson 2015). Take as an example the idea of God, which Descartes sometimes claims to be the clearest and most distinct idea of all (AT VII 46, CSM II 32). Some of the "consequences" that he derives from this idea are that God exists (see the **ontological argument**), that God "tends toward being" and is thus the source of all being and goodness, the law of **inertia** (see **law of nature**), and the doctrine that the **eternal truths** are created. As recent scholarship has shown, the last-named doctrine follows from Descartes' strict understanding of divine simplicity and thus is not unmotivated after all (Walski 2003). Christian philosophers have traditionally held that God is simple, but Descartes' innovation is to show what this entails about divine creation (he is thus *correcting*, rather than borrowing from, his predecessors). He takes it to follow that there is no distinction (or priority) in God between understanding and willing (or creating).

Thus, whatever God understands, he wills, and vice versa. This means that absolutely everything depends for its existence on the divine will, including the eternal truths (AT I 152–53, CSMK 25–26; cf. AT I 149–50, CSMK 24). It also follows from divine simplicity that God’s will is completely indifferent in the sense of being unconstrained by anything, including his **intellect**. This entails that divine freedom consists in indifference in this special sense.

Like the idea of God, the clear and distinct idea of body as pure extension has several systematic consequences, among them:

1. A body just is its extension; this collapses the Aristotelian distinction between matter and form since extension is the form (see **form, substantial**).
2. There is only one type of matter (not heavenly matter and earthly matter, as in Aristotle’s **cosmology**).
3. Since all bodies have the same essence, there are no natural kinds or species.
4. Since a body just is spatial dimension, a **vacuum** or empty space is impossible.
5. Since extension by its very nature is divisible, **atoms** are impossible.
6. As bare extension, matter is inert, and so any **motion** in the universe must be imposed upon it (by God).

It is sometimes wondered how Descartes’ metaphysics grounds his physics (as he says in the letter to Mersenne cited earlier in this entry). The answer is complex but one clear way it does so is by offering a revolutionary conception of matter, from which these many consequences follow. It is notable, however, that the consequences are in metaphysics-cum-physics. Cottingham claims that Descartes’ innovations are in science, not metaphysics, but drawing a sharp distinction between the two is anachronistic, as Descartes’ physics is inherently “metaphysical,” leading one commentator to speak of Descartes’ “metaphysical physics” (see Garber 1992).

Returning to the other two considerations raised earlier, one is now better placed to appreciate why they do not pose much of a threat to the systematic character of Cartesian metaphysics. Regarding the first, the reason Descartes never writes a metaphysical treatise is because he holds that the “primary notions” in metaphysics conflict with the senses and the philosophical **prejudices** they engender. As a result, these notions require the greatest effort to make clear and distinct. One cannot simply take them as primitive, as one can with the axioms of **geometry**. Consequently, Descartes thinks that the geometrical (or synthetic) method of presentation is ill-suited to metaphysics and would object to Spinoza’s deployment of it in his *Ethics* (AT VII 156–57, CSM 110–11) (see **analysis versus synthesis**). It also explains why his treatment of metaphysical issues in works like the *Meditations* is so laden with epistemological concerns such as skepticism. Subjecting his readers’ beliefs to systematic **doubt** is the most efficient way of extirpating their prejudices so that they can appreciate the primary notions of metaphysics.

As for the third consideration, there is no denying that Descartes' treatment of some metaphysical issues, such as the principle of individuation for bodies, is woefully deficient. Descartes is very different in this regard from Leibniz, whose philosophical system had broader reach and who was interested in metaphysical questions for their own sake. Leibniz's positions on issues such as the nature of substance evolve over time, and he allows himself to experiment with various positions. By contrast, Descartes' metaphysical system is set down in print rather late in his career and remains relatively fixed (though some commentators hold that he develops his views between the publication of the *Meditations* [1641] and the *Principles* [1644] in light of objections to the former and as a result of reading Scholastic textbooks in preparing to write the latter [see, e.g., Ariew 2011]). The explanation for at least some of these differences is again Descartes' belief that philosophy proper is something one does "once in a lifetime," as a prelude to science. As a result, Descartes is something of a metaphysical minimalist. He requires just enough doctrine to ground the new science and to secure the two great truths of religion – the existence of God and the immortality of the soul. (However, whether Descartes even attempts the latter is controversial. See **soul, immortality of** for evidence that he does. At the very least, his proof of real distinction between mind and body is intended to show that immortality is possible.) But it is important to remember that the simple and unadorned nature of Cartesian metaphysics is one of its central attractions. Its main outlines could be written on the back of a postcard: there is God, there are two kinds of created substance, and all other entities are reducible to these substances or to their attributes or modes. Leibniz's philosophy and Scholastic metaphysics (with its proliferation of entities and overly subtle distinctions) seem baroque by comparison.

See also Attribute; Being, Formal versus Objective; Body; Cause; Distinction (Real, Modal, and Rational); Dualism; Eternal Truth; Essence; Existence; Extension; Form, Substantial; Free Will; God; Human Being; Individuation; Mind; Mode; Nature; Quality, Real; Quality, Sensible; Scholasticism; Simple Nature; Soul, Immortality of the; Substance; Time; True and Immutable Nature; Universal

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LAWRENCE NOLAN

METEORS

The field of "meteorology" (as it was traditionally understood) is circumscribed by Aristotle's *Meteorologica* – one of the smaller physical treatises. According to Aristotle, it is concerned with "events that are natural, even though their order is less perfect," which take place "in the region nearest to the **motion** of the stars." More particularly, it would make a study of "the properties shared by air and water, and the kinds and parts of the earth and the affections of its parts," so light can be thrown "on the causes of winds and earthquakes ... thunderbolts, whirlwinds and fire-winds," as well as an account given of more complex substances – more complex, that is, than earth,

water, and air. Finally, Aristotle admits that meteorology is not a perfect science because the causal scheme that was believed to be essential for **explanation** does not completely apply (final **causes** in particular – the idea that meteorological phenomena have a purpose was seen as unphilosophical) (I.i.338a20–339a9). In any case, the subject matter of meteorology could be defined in different ways: either as the study of all phenomena that occur between the earth’s surface and the moon, or as a discussion of the **elements**, or as the study of the various forms taken by water and vapor.

Descartes started work on his *Météores* in the late summer of 1629, after reading a description of the *parhelia* (sundogs or mock suns) observed earlier that year by the **Jesuit** Scheiner (1573/75–1650). He first gave his own **explanation** of the same phenomenon, then proceeded to the **rainbow** and eventually added explanations of wind, rain, and snow, of elementary chemical processes, and of atmospheric phenomena. The basis of most of these explanations is formed by a few “suppositions,” necessary because as yet Descartes was not prepared to disclose his principles. It is assumed, first, that all qualitative differences between the elements can be reduced to differences in form, mass, and motion of elementary particles; and, second, that there is no **vacuum** and that the room between the particles is filled with what Descartes calls **subtle matter** – a very fine and pliable substance, composed of the same matter as the other elements. Whereas, according to Descartes, the mechanical properties of matter (form, mass, motion) adequately explain the static properties of macroscopic bodies, subtle matter (which he had already used in the *Dioptrics* to explain the transmission of **light**) must intervene to explain the transformation of bodily substances under the influence of heat and light (see **optics**). Subtle matter, impacting macroscopic bodies, generates heat and so forms the ultimate explanation of processes like calcination and putrefaction.

Although before long Descartes dropped the project of a meteorology in favor of a more complete treatise of **physics** (later known as *The World*), he kept the manuscript, continually adding observations and explanations. Eventually the text was added to the *Discourse* (1637) as one of the “essays” because it allowed Descartes to provide an outline of his physics “without giving rise to controversy or revealing more of [his] principles than [he] wished” (AT VI 75, CSM I 149). In the end, that also proved to be its weakness. For not only did all explanations remain hypothetical (cf. AT VI 233 and AT VI 76, CSM I 150); they also led many people to believe that Descartes was an atomist, an association that Descartes vehemently rejected (AT I 413, CSMK 61; AT VIIIA 325, CSM I 287). And although Descartes had hoped that, like Aristotle’s *Meteors*, his essay could serve as an introduction to physics, the Jesuits completely ignored it. The only one to make some use of it was the Utrecht professor of medicine **Henricus Regius** (1598–1679), who on the basis of the *Meteors* and the *Dioptrics* elaborated a compendium of physics that he used in his classes (see *Letter to Father Dinet*, AT VII 582–83).

See also Atom; *Discourse on Method*; Element; Explanation; Jesuit; Optics; Physics; Regius, Henricus; Subtle Matter

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THEO VERBEEK

METHOD

"The Plan of a Universal Science [*Le projet d'une Science universelle*] which is capable of raising our Nature to its Highest Degree of Perfection, together with the *Dioptrics*, the *Meteors* and the *Geometry*, in which the Author, in order to give proof of his universal Science, explains the most abstruse Topics he could choose, and does so in such a way that even persons who have never studied can understand them" (AT I 339, CSMK 51). This long and cumbersome original title of Descartes' *Discourse on Method* (1637) conveys the highly ambitious yet elusive nature of Descartes' method. He sometimes seems to present it as an epistemological panacea, claiming that it can "solve all the problems that have never yet been solved" in *geometry* (AT I 340, CSMK 51) and that it even "extends to topics of *all* kinds" (AT I 349, CSMK 53). Employing this wonderful method, Descartes claims, we could "make ourselves, as it were, the lords and masters of nature" (AT VI 62, CSM I 142–43). Indeed, in one of his most conspicuous expressions of his appreciation for his own method, Descartes boasts that it is far superior to that of his critic, **Hobbes**, even though the latter never claimed to have any method (AT VII 174, CSM II 123).

The two main texts in which Descartes discusses his method are the posthumously published *Rules for the Direction of the Mind* and the *Discourse*. Unfortunately, neither of the two works provides a complete presentation of the method. The *Rules* is an unfinished work; it was intended to contain thirty-six rules, but the extant versions of the work include only twenty-one (and the last three of these do not have the detailed elaboration that accompanied the others). Descartes worked on the *Rules* throughout the 1620s but had deserted it by 1628 (Garber 1992, 31). In the *Discourse*, he explains his reason for offering a minimalistic new presentation of the method: "A multiplicity of laws often provides an excuse for vices, so that a state is much better governed when it has but few laws which are strictly observed; in the same way, I thought, in place of the large number of rules that make

up logic, I would find the following four sufficient, provided that I made a strong and unswerving resolution never to fail to observe them” (AT VI 18, CSM I 120). These four rules, however, cannot be considered a complete presentation of the method; in a letter to **Mersenne**, Descartes stresses that his choice of the title “*Discourse on Method*” – rather than “*Treatise on Method*” – indicates that the work is supposed to be merely a *preface* to the method (AT I 349, CSMK 53). Thus, it seems that neither the long but incomplete *Rules* nor the complete but merely prefatory *Discourse* can provide us with a full exposition of Descartes’ method. One might be tempted to consider the three treatises (*Dioptrics*, *Meteors*, and *Geometry*) that Descartes attached to the *Discourse* as authoritative demonstrations of the method (indeed, the title of the 1637 book describes the three works as “essays” in the method). Yet, such a conclusion seems premature; in a 1638 letter, Descartes insists that the three works follow a certain “order of exposition” that is distinct from the order of discovery prescribed by the method (see **analysis versus synthesis**). Thus, the three works are supposed to show the achievements of Descartes’ method, but they do not demonstrate its use (AT I 559, CSMK 85).

Since the four concise rules of the *Discourse* give us an authoritative outline of the method of the mature Descartes, we quote them *in extenso*:

The *first* was never to accept anything as true if I did not have evident **knowledge** of its **truth**: that is, carefully to avoid precipitate conclusions and preconceptions, and to include nothing more in my **judgments** than what presented itself to my **mind** so clearly and so distinctly that I had no occasion to **doubt** it. The *second*, to divide each of the difficulties I examined into as many parts as may be required in order to resolve them better. The *third*, to direct my thoughts in an orderly manner, by beginning with the simplest and most easily known objects in order to ascend little by little, step by step, to knowledge of the most complex, and by supposing some order even among objects that have no natural order of precedence. And the *last*, throughout to make **enumerations** so complete, and reviews so comprehensive, that I could be sure of leaving nothing out. (AT VI 18–19, CSM I 120)

The concise and simple formulation of the four rules may appear attractive, but it led to charges that Descartes was asserting only trivial platitudes. **Leibniz** noted that these rules seem like the advice of some chemists: “Take what is needed; do as you ought; and you will get what you wanted” (Leibniz 1875–90, 4:329; cf. Broughton 2002, 3–4). Indeed, one may wonder whether Descartes’ method, the rules of which were supposed to extend beyond **mathematics** and cover the practice of **philosophy** and the sciences, did not culminate in prescriptions that could just as well apply to more mundane activities like shopkeeping. Perhaps one way to mitigate this worry would be to observe the strength of the first rule of the *Discourse*, which is not likely

to be helpful in casual practices (such as shopkeeping): “to include nothing more in my judgments than what presented itself to my mind so clearly and so distinctly that I had no occasion to doubt it.” Similarly, Descartes prescribed in the early *Rules* that one should “believe only what is perfectly known and is incapable of being doubted” (AT X 371, CSM I 10).

Doubt has an important role in Descartes’ method, though we should keep in mind that it is only one element of it (see Williams 1990, 33–34, and Broughton 2002, 2–7). The use of the procedure of doubt is evident in the *Meditations on First Philosophy* (1641), Descartes’ most famous work, but the *Meditations* also clearly exhibits the application of the other three rules of the *Discourse*. The main argument of the book – a proof of the **existence** of **God** and the survival of the soul – is split into a series of well-defined steps (second rule). The order of discovery begins with the knowledge that is most simple and accessible to the mediator (i.e., the existence of the I) and proceeds from there step by step (third rule). Each meditation begins with a recapitulation of the previous moves (fourth rule).

When we compare the rules of the *Discourse* with those of the *Rules*, it is evident that each of the four rules of the former has one or more counterparts among the first twelve rules of the latter. The *Rules*’ second (and incomplete) set of twelve rules focuses on method in mathematics, and specifically on the thorny issue of mathematical symbolism. Inspired by his outstanding success in algebraic geometry, Descartes considered mathematics a paradigmatic science, whose fruitful methods should be extended to the other sciences (AT VI 21, CSM I 121).

The unity of the sciences is a topic stressed in both the *Rules* and the *Discourse*. Thus, elaborating on the first rule of the *Rules*, Descartes writes: “The sciences as a whole are nothing other than human wisdom, which always remains one and the same, however different the subjects to which it is applied” (AT X 360, CSM I 9). Within this unified view of the sciences, Descartes suggests a certain hierarchy, observing in the second part of the *Discourse* that the principles of the sciences “must all be derived from philosophy” (AT VI 21–22, CSM I 121–22). He enshrined this hierarchical view in the preface to the *Principles of Philosophy*, with the famous image of the “tree of knowledge,” of which “the roots are **metaphysics**, the trunk is **physics**, and the branches emerging from the trunk are all the other sciences” (AT IXB 14, CSM I 186).

Interestingly, Descartes presents his method of discovery as quite flexible on crucial issues, such as whether to begin an inquiry from **causes** (and deduce the effects) or from effects (and trace the causes). In the sixth part of the *Discourse*, Descartes writes: “First I tried to discover in general the principles or first causes of everything that exists or can exist in the world. To this end I considered nothing but God alone, who created the world.... Next I examined the first and most ordinary effects deducible from these causes. In this way, it seems to me, I discovered the heavens, the stars, and an earth; and, on the earth, water, air, fire, minerals, and other

such things which, being the most common of all and the simplest, are consequently the easiest to know.” After he had “deduced” the first effects of God, this method of progressing from causes to effects ceased to be useful. Subsequently, Descartes *reversed* the order of inquiry:

Then, when I sought to descend to more particular things, I encountered such a variety that I did not think the human mind could possibly distinguish the forms or species of **bodies** that are on the earth from an infinity of others that might be there if it had been God’s will to put them there. Consequently I thought the only way of making these bodies useful to us was to progress to the causes by way of the effects.

At this point, Descartes employs the fourth rule of the *Discourse*: “And now, reviewing in my mind all the objects that have ever been present to my senses, I venture to say that I have never noticed anything in them which I could not explain quite easily by the principles I had discovered” (AT VI 63–64, CSM I 143–44). It seems that Descartes allows the third rule of the *Discourse* to be interpreted in different, even opposite, ways. While the idea of God is most simple and accessible to the human mind, the immediate effects of God might be less accessible to our minds than particular things that we encounter in our intimate experience.

Another issue that is closely related to Descartes’ method is the distinction he develops (in the *Second Replies*) between analysis and synthesis as manners of demonstration (see **analysis versus synthesis**). In the Synopsis of the *Meditations*, Descartes presents the work as written in the order “normally employed by the geometers” (AT VII 13, CSM II 9). Yet, when Mersenne asks Descartes to fully abide by this statement and prove the chief thesis of the *Meditations* “in geometrical fashion, starting from a number of definitions, postulates, and axioms” (AT VII 128, CSM II 92) (see **geometrical exposition**), Descartes expresses serious reservations about the employment of such method of demonstration – which he terms “synthetic” – in metaphysics. The alternative method of demonstration – analysis – “shows the true way by means of which the thing in question was discovered,” that is, it is far closer to the Cartesian method of discovery. The analytic method is far more appropriate for metaphysical inquiry because metaphysics – unlike geometry, whose primary notions “are readily accepted by anyone” – requires “so much effort [to make] our **perception** of the primary notion clear and distinct” (AT VII 155–57, CSM II 110–11).

The early modern reception of Descartes’ method was somewhat mixed (see Méchoulan 1988). The fourth part of the *Port Royal Logic* is heavily indebted to Descartes’ discussion of method and may contain a paraphrase of missing material from the *Rules* (AT X 471–72, CSM I 77–78). Many of Descartes’ contemporaries and immediate successors considered his method as encouraging skepticism. Of

those, some (e.g., **Voetius** and Martin Schook) brought the charge of encouraging skepticism in order to argue that his philosophy leads to heresy, while others (e.g., **Foucher** and **Huet**), being more sympathetic to skepticism, attempted to explain away Descartes' claim that he used the procedure of doubt for mere methodical purposes (see Lennon 2008, 59–62). Of **Spinoza's** works, the closest in spirit and content to Descartes' discussions of method is the *Treatise on the Emendation of the Intellect*, which is likely his earliest extant work. The Cartesian method might have influenced Spinoza's "method for interpreting scripture" in the *Theological Political Treatise* (ch. 7, G III/98–100), though Spinoza's stress on the construction of the natural history of the text goes beyond anything in Descartes. In his mature *Ethics*, Spinoza has far less sympathy for the Cartesian method, which seems to be one of the main targets of his scathing critique of the gravely misleading "order of philosophizing" employed by his predecessors (see E2p10s2; cf. Melamed 2009).

See also Analysis versus Synthesis, Cause, Clarity and Distinctness, *Discourse on Method*, Doubt, Enumeration, Geometry, Knowledge, *Mathesis Universalis*, Rules for the Directions of the Mind

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YITZHAK MELAMED

MEYSSONNIER, LAZARE (1611–1673)

Meyssonnier was physician to King Louis XIII and professor of surgery in Lyon. The main body of his work can be found in the *Pentagonum philosophico médico* and, in particular, in the republication of the *Miroir de beauté et de santé corporelle* by Louis Guyon de la Nauche (1625), after 1633. Following successive rewording and expansion, this work became the leading practical and theoretical medical course in French. It was published the same year as the posthumous edition of Descartes' *Treatise on Man* (1664) and contains numerous references to *Dioptrics*, *Passions of the Soul*, and the letters exchanged with Descartes at the beginning of the 1640s.

Meyssonnier was introduced to Descartes by **Mersenne**, to whom he had sent *Pentagonum* on February 25, 1639. In a letter to Mersenne dated January 29, 1640, Descartes reports that he had received him in person. He also expresses reservations regarding the mix of "astrology, palmistry, and other such nonsense" that he believes punctuates the volume (AT III 15). In a brief letter to Meyssonnier of this same date and another more detailed one that was addressed to him care of Mersenne, Descartes responds to this royal physician's apparent inquiries concerning the function of the **pineal gland** (or *conarium*) and whether corporeal memories are stored there exclusively (see **memory**). First, he explains that the function of the pineal gland, given its unity, mobility, and unique position near the center of the brain, is to unite (but not preserve) the innumerable impressions that are received by the two eyes, two ears, and other senses before they are perceived by the soul. Second, he notes that while some species of memory can be found there, especially in people with "course minds" and in **animals**, memories are typically found in the brain as a whole. Third, he notes that memories can even be found in the nerves, muscles, and, for someone skilled in using his body such as a lute player, in the hands. "You

will find this easy to believe if you bear in mind that what people call ‘local memory’ is outside us: for instance, when we have read a book, not all the impressions which can remind us of its contents are in our brain. Many of them are on the paper of the copy which we have read.” Fourth, he insists that these impressions do not resemble the “things of which they remind us” (referring to what he wrote in the Fourth Discourse of *Dioptrics*) and draws a distinction between corporeal memory and intellectual memory, which depends on the soul alone. Fifth, he asserts that the reason the pineal gland has not yet been directly observed in the anatomy of the human brain is due to the flawed order of dissection, which allows the brain to rot (AT III 19–20, CSMK 143–44; AT III 47–49, CSMK 145–46).

The exchanges between Descartes and Meyssonnier constitute a vital tool for studying the relationship between mechanistic physiology and chemistry, on the one hand, and metaphysical **dualism**, on the other. **Queen Christina of Sweden** understood this well. When passing through Lyon in 1656, she asked to visit the city and hold a meeting with Meyssonnier.

See also Dualism; Memory; Mersenne, Marin; Pineal Gland

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DELPHINE ANTOINE-MAHUT

MIND

Mind (*mens*) – also called “rational soul” – traditionally identified with **intellect** (*intellectus*) and **reason** (*ratio*), was considered since antiquity the seat of the highest psychic powers. It was not only the part of the soul that was immaterial (not requiring corporeal organs for its operation), and so indestructible, but was also the source and instrument of the highest kind of human perfection – understanding – that came with the highest kind of bliss or **happiness**. The mechanistic view of nature challenged philosophers to revise or, as the case may be, break loose from

inherited conceptions of mind and its relation to the world that did not really fit with it. Among the first to meet this challenge was Descartes, who laid out the conceptual framework within which subsequent discussions of mind and its nature were conducted. Descartes redefined mind in terms of **thought** in a broad sense so that it includes not just intellect, but also the will, sense perception, **imagination**, and feeling. He thus transformed the notion of the mind in ways that directly or indirectly have influenced all subsequent theorizing on the human mind and its powers in the Western tradition. Nevertheless, the continuities between his conception of mind and Scholastic philosophical psychology are greater than his terminological innovations may seem to suggest (see Carriero 2009). This article focuses on mind mainly in the restricted sense of intellect, understanding, and epistemic subject.

1. MIND IN THE EARLY WRITINGS

Descartes' concern with understanding and mind grows out of his early work in **mathematics** and philosophy of nature, particularly his project of developing a general **method** of scientific discovery for which mathematics – arithmetic/algebra and **geometry** – provided a paradigm (see *Rules for the Direction of the Mind*). The unfinished methodological project was later replaced by an even more ambitious metaphysical project announced in the *Discourse on Method* (1637) and worked out in the *Meditations on First Philosophy* (1641). In these well-known works, Descartes makes a strong case for a new kind of **dualism** or, in traditional terminology, “real distinction” between mind and **body**, redefined in terms of thought and **extension** respectively. Descartes' early scientific work had turned physical nature into what can be understood only in terms of extension and related “distinct” concepts and quantitative terms. What cannot be understood in terms lending themselves to mathematical analysis is attributed to a separately created “rational soul” (AT I 141, CSM I 101; AT VI 46, CSM I 134) that Descartes in his metaphysical writings labels “soul” (*âme* in the French *Discours*: AT VI 33, CSM I; *anima* in the subtitle of the Latin *Meditationes*: AT VII 17), and human mind (*mens humana*) in the text of the *Meditations* (AT VII 23), and sometimes also thinking thing (*res cogitans*: AT VII 27–28).

In the early, unfinished *Rules*, the term “mind” is a translation of the Latin *ingenium*, which stands for our natural and inborn mental or intellectual ability (see **native intelligence**). It is also referred to as “good sense” (*bona mens*), that is, Descartes adds, “this universal wisdom” (AT X 360), and, at the very end of the first rule, as the “natural light of reason” (*naturalem rationis lumen*). The aim of the rules Descartes proposes is to “direct the mind with a view to forming true and sound **judgment** about whatever comes before it” (AT X 359, CSM I 9).

Although Descartes is not very particular about defining the terms he uses in describing this natural intellectual ability, he seems to think of it first and foremost as a power to distinguish the true from the false, which he elsewhere calls judgment (*judicium*) and that is called reason (*raison*) or good sense (*bon sens*) in the *Discourse* (AT VI 2), and mind (*mens*), intellect (*intellectus*), power of judgment (*judicium*), or simply thought (*cogitatio*) in the *Meditations*. This power is “innate” in the sense of belonging to the nature of the human mind.

The intellect alone provides evident and certain **knowledge** and is said to operate by intuition (the light of reason) and **deduction**, from which it differs only through its simplicity and immediate **certainty**. Thus, each of us can intuit “that she exists, that she thinks, that the triangle is bounded by just three lines, the sphere by a single surface, and the like” (AT X 368, CSM I 14). Intellectual intuition or the clear and distinct “indubitable conceptions of the pure and attentive mind” (*mentis purae & attentae non dubium conceptum*) are given precedence over sensory **perceptions** as the ultimate source of evidence, and its conceptions (i.e., purely intellectual perceptions) are set up as norms for certain knowledge (see **clarity and distinctness**). Other **faculties** or instruments of cognition, like the imagination, the senses, and **memory**, which depend on bodily organs, are needed to assist it, but “the intellect alone is capable of perceiving the **truth**” (AT X 411, CSM I 39).

The view of the mind here sketched, if not quite the same as his mature view, anticipates it in many ways. While treating mind and body as two distinct natures, Descartes takes the latter to be informed by the former so that they together form a “composite.” He also takes the mind, when engaging in the cognitive activities of sense perception and imagination to operate “within the whole composite,” although when engaged in intellection the mind works independently of the body (AT X 416, CSM I 42). Although these are traditional formulas, the view they express is certainly not. The basic ideas of the mechanistic physiology developed in the later works (see *The World*, *Dioptrics*, and the *Discourse* V) are already in place, for Descartes explains how the nerves, originating from the brain, could be understood to move the members of the body just in the same way as we, with the help of the pen analogy, can understand the **common sense** to be moved by the external senses, through local **motion**. He illustrates it here using the old metaphor of the seal and wax, interpreting it quite literally in explaining “the corporeal phantasy” (AT X 412–15, CSM I 40–42). The vital and cognitive functions that take place mechanically are shared with “other **animals**” in which they work without any knowledge and reason, without, that is, the mind or intellect having any part of it.

When turning to the cognitive power, that is, the intellect itself, which is not reducible to the movements in the brain, the seal-wax metaphor is used as a mere **analogy**, for “this force by which things are known properly speaking” has to be conceived as “purely spiritual, and no less distinct from the whole body than the blood

from the bones, or the hand from the eye.” It is the same power that is passive like wax, in receiving figures from the common sense at the same time as the phantasy, and active in applying itself to the figures preserved in the memory, or in forming (like a seal) new ones. There is nothing “quite similar” to this in corporeal things” (AT X 415, CSM I 42). It is one and the same power that, depending on its different functions, is called imagination, memory, sense (when it applies itself to common sense and works with the corporeal organs), or intellect, when it understands (and acts alone) (AT X 416, CSM I 42). When applying itself to the imagination, it is called *ingenium* properly, while the same power is called pure intellect (*intellectus*) when it acts alone, without the help of the imagination. It is not clear how consistent Descartes was about this last distinction (he does not use the term *ingenium* in later writings), but it is noteworthy that the operations of the different cognitive faculties are here, as later, treated as functions of one and the same power operating in all these different ways, depending on what it is applied to and what its function is. Both the traditional faculty psychology and, with it, the distinction between different kinds of souls (the sensitive and the intellective) are abandoned and replaced by a monistic conception of soul or mind anticipating the broad **definition** of thought or mind developed in Descartes’ later writings.

2. THE *MEDITATIONS* AND THE HUMAN MIND

Descartes introduces a new kind of philosophical entity or persona in the Second Meditation, referred to in the text as the “I” or “mind” (*mens*) or thing that thinks. Having reached the conclusion “that this proposition, *I am, I exist*, is necessarily true whenever it is put forward by me or conceived by my mind,” Descartes goes on to reflect on the nature of “this ‘I’” whose **existence** has now been ascertained. Former beliefs about himself, for example, “a man,” “a rational animal,” a being with a mechanically structured body (“which can be seen in a corpse”) and a soul accounting for various activities he attributed to himself, like being nourished, moving about, engaging in sense perception and thinking, are considered but discarded with exception of the last, thinking – the only activity withstanding systematic **doubt**. So he concludes that his newly discovered self is in “a strict sense only a thing that thinks; that is, I am a mind (*mens*; *esprit*), or intelligence (*animus*), or intellect (*intellectus*; *entendement*), or reason (*ratio*; *raison*) – words whose meaning I have been ignorant of until now” (AT VII 27, CSM II 18).

While many of Descartes’ Scholastic predecessors could agree that the mind so described is the most perfect part of man, they would generally not identify the self with the mind alone, or conclude that none of the things that can be sensed or pictured by the imagination belong to one’s self as a mind or thinking being (AT VII 28, CSM II 19). Yet, reflecting on his acts of thought Descartes finds some further

characteristics to add to the things he can be certain of, and comes up with the following expanded list in answer to the famous question “What then am I?”: “A thing that doubts, understands, affirms, denies, is willing, is unwilling, and also imagines and has sensory perceptions” (AT VII 28, CSM II 19). What was initially described as a mind or intellect or reason, now includes “willing and unwilling,” and also, surprisingly and as an afterthought, “imagining and sensing” (cf. AT VII 34, CSM II 24; AT VII 78, CSM II 54; AT VIIIA 23, CSM I 41). Later emotions or **passions**, for example, love and hate, are added to the list (see, e.g., AT IX 27). Hence, although none of the things he imagines or senses belong to his self in the strict sense, having the ability to imagine and experience various sensations and emotions is retained as part of his self taken strictly as a thing that thinks. Thus, Descartes assigns faculties to the mind that among the Aristotelians were assigned to the animal soul and whose activities were thought to occur in the body rather than the mind.

As concluded in the Sixth Meditation, the mind or self, in the restricted sense of a thinking thing, is really distinct from extended things and can exist without them (AT VII 78, CSM II 54). But in spite of being distinct in nature from extended things, the human mind is also really united to the body (whose existence has now been proved!) and forms a whole with it. The self, or mind, or thing that thinks has faculties for these special forms of thinking, imagination, and sense perception (AT VII 78, CSM II 54), which include some act of intellection or understanding “in their formal concept,” but their operation presupposes that the mind is also united to a body with the appropriate organs (AT VII 79–80, CSM II 54–56).

We can thus talk of the Cartesian Self in a strict sense as a mind or, in an extended sense, as a mind-body union. The first represents intellectual nature – the part of its nature that the **human being** shares with disembodied beings and **God**. The latter represents what Descartes calls a “real man,” that is, the human being or **person** as a whole, whose main characteristic is thinking but who is also part of extended nature and subject to its laws. Descartes’ notion of the mind-body union is problematic given his definitions of mind and of body, and its interpretation a matter of controversy (see, e.g., Wilson 1978, Rozemond 1998, Alanen 2003, Hoffman 2008, and **human being**).

Note that the mind considered in the first, strict sense, in abstraction as it were from the body, is an individual self or entity. Descartes does not dwell on what individuates the human mind considered apart from the body but seems to take for granted that it is an individual subject – the referent of “I” insofar as I – the very same subject that is engaged in the project of the *Meditations* – am now turning inward, away from my senses, to inspect my “thoughts” (see **individuation**). This Self comprises the essential core abilities that constitute what Descartes calls a mind in the strictest sense, which includes both the intellect and the will. That the will should be included is not, in itself, surprising. The proper object of the intellect being the truth, the intellect was traditionally seen as equipped with an appetite for it which

makes it naturally tend toward truth and shun falsity. Yet the view here announced turns out to be novel as further discoveries about the mind in the subsequent meditations and the later work reveal.

Traditionally the mind or intellect is defined through its activity – the acts of understanding being the very paradigm of pure, unimpeded activity. Descartes treats the will as a separate power, to which he attributes not only all the mind's motive tendencies but also its power of activity, that is, its power to assent to or deny what the intellect presents or apprehends. The intellect is hereby turned into a passive power of perception or apprehension that requires active engagement of the will not only for attending to its clear and distinct perceptions but also for forming judgments and, more generally, for exercising its intellectual capacities in the pursuit of truth or knowledge, functions traditionally attributed to the intellect. According to the doctrine developed in the Fourth Meditation, it is not the intellect but the will that through its power of free decision (*liberum arbitrium*) constitutes the highest human perfection. Even though the will is naturally geared to follow the intellect, it is not necessarily determined by it. In elevating the will into a power of its own that can operate independently of the intellect and control it, at least indirectly, through attention, Descartes restricts the intellect to a power of passive representation and intuition. The mind in the narrow sense here considered can no more be identified with the intellect alone, and it constitutes the highest human capacity only insofar as it includes the will. If the perfection of the will depends on its aligning itself with the intellect in the pursuit of the true and the good, the burden of responsibility for so doing now depends on the commitment of the will, which through its two-way power is free to forsake this pursuit whenever it so chooses (AT VII 56–57, CSM II 39–40; AT VIIIA 118). (For Descartes' notion of mind in the larger sense, including the other cognitive and conative functions traditionally attributed to the animal soul, see **thought**.)

See also Body; Dualism; Faculty; Free Will; Human Being; Imagination; Intellect; Judgment; Native Intelligence; Passion; Perception; Reason; Sensation; Senses, External versus Internal; Soul, Immortality of the; Substance; Thought

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LILLI ALANEN

MODE

Descartes inherited from the Aristotelian tradition a model of reality comprising **substances** and affections or **modes** that inhere in substances. But he reduced the kinds of substance to just two and made the inherence relation strong enough to block what he considered the ontological excesses of **Scholasticism**. In a general sense, modes are the various ways of qualifying or conceiving of substances. We can speak or conceive of the duration, number, or **shape** of a given object; so all of these are its modes. In a more precise sense, only those features of an object that admit of variation are modes. In this sense, shape is a mode while duration and number are classified as "**attributes**" since a thing can change its shape but cannot cease to endure (or become more or fewer) without ceasing to exist (AT VIIIA 30, CSM I 214). And since **God** is absolutely immutable, he has no modes, only attributes (AT VIIIA 26, CSM I 211). Order, duration, and number may be termed "generic attributes" since they "extend to all classes of things" (AT VIIIA 23, CSM I 208). But there are also two "principal attributes," **thought** and **extension**, which bifurcate the world of substance into two natural kinds: **minds** and **bodies**. The principal attributes have their characteristic modes: minds change as thought takes on various **perceptions** and volitions; bodies change as extension takes on various shapes and

motions. And these modes account for everything we perceive in things: “Each substance has one principal property which constitutes its nature and **essence**, and to which all its other properties are referred” (AT VIIIa 25, CSM I 210).

Descartes would dismiss the question whether modes properly pertain to a substance or to its principal attribute since there is merely a conceptual, rather than a real or modal, distinction between a substance and its attributes (see **distinction [real, modal, and rational]**). That is, “we are unable to form a clear and distinct idea of the substance if we exclude from it the attribute in question” (AT VIIIa 30, CSM I 214). In reality, the principal attributes thought and extension just are minds and bodies: “They must be considered as thinking substance itself and extended substance itself, that is as mind and body” (AT VIIIa 30–31, CSM I 215). There is also merely a conceptual distinction among the various attributes of a single substance.

Besides the mode-attribute distinction, Descartes hints at a distinction between modes (in the precise sense) and “qualities”: “When the modification allows the substance to be designated as such and such a kind, we use the term quality” (AT VIIIa 26, CSM I 211). However, this is not a term that Descartes uses frequently, and it is not clear whether its meaning is distinct from the precise sense of mode. For a mode, like a perception or a shape, certainly designates its substance as a kind. There are second-order modes of modes (AT III 355, CSMK 178). The particular speed of a body is a modification of its motion. And a mental affirmation is a modification of willing, which is in turn a mode of thought (AT VII 57, CSM II 40).

Whereas attributes, whether generic or principal, are in reality the same as substances and only conceived differently, modes bear a relation of asymmetric dependence to substances. Substances can exist apart from their actual modes but not vice versa: “We can clearly perceive a substance apart from the mode which we say differs from it, whereas we cannot, conversely, understand the mode apart from the substance” (AT VIIIa 30, CSM I 214). A thing can be extended without being spherical but not vice versa, just as a person can be an athlete without being a pole-vaulter but not vice versa. This is simply because all the modes of a thing are merely various ways its principal attribute is expressed (in Latin, *modus* = “way” or “manner” of being). In this respect, as Secada (2000) and others have noted, Descartes’ attribute-mode relationship is reminiscent of the Scholastic distinction between determinables (such as color) and their determinates (such as red). So Cartesian modes are nothing over and above the essences of bodies and minds and, unlike Aristotelian “real accidents,” cannot be separated from substances. Inasmuch as **extension** is a purely geometrical notion, all the modes of body (such as motion and shape) are also geometrical. Descartes uses the term “modally distinct” both for the substance-mode relation and for the mode-mode relation within a substance.

We perceive the modes of bodies by sense and **imagination** but grasp the attribute extension by the **intellect** alone. In a famous thought **experiment**, Descartes

discovers that the extension of a piece of **wax** must be grasped by the intellect since he understands clearly that this attribute could survive any modal change he perceives or imagines (AT VII 30–33, CSM II 20–21). Similarly, it is manifest to the intellect that one thinking thing, or “I,” underlies all our fleeting **ideas** and mental operations: “The fact that it is I who am doubting, understanding and willing is so evident that I can see no way of making it any clearer” (AT VII 29, CSM II 19). The clarity and distinctness in our conceptions of attributes enables us to comprehend clearly their characteristic modes. If we regard shapes and motions as merely modally distinct from extended substances, “our understanding of them will be capable of being just as clear and distinct as our understanding of the substance itself” (AT VIIIA 31, CSM I 215). But there are various other features we perceive in things (e.g., colors, pains, smells, taste) that we understand less well: “Our knowledge of what it is for the body to have a shape is much clearer than our knowledge of what it is for it to be colored” (AT VIIIA 34, CSM I 218). These sorts of modes are perceived clearly and distinctly “only when they are regarded merely as **sensations** or thoughts” (see **clarity and distinctness**) (AT VIIIA 33, CSM I 217). When I illicitly refer such modes to things outside me, “I think of these only in a very obscure and confused way” (AT VII 43, CSM II 30).

Descartes uses “mode of thinking” and similar expressions in two very different senses, which might cause confusion. In the strict sense, modes of thinking are simply the changeable acts of a thinking substance, such as sensations, volitions, and imaginings. But in several passages this is not his intention. For example: “In the case of all the modes of thought which we consider as being in objects there is merely a conceptual distinction between the modes and the objects they are thought of as applying to” (AT VIIIA 30, CSM I 214). But duration (the example he has just offered) could not both depend on the mind in the strict sense of “mode of thought” and be the same as enduring objects. What he means rather is that duration, and the other attributes, are “ways of considering” things: “We should regard the duration of a thing as simply a mode under which we conceive the thing in so far as it continues to exist” (AT VIIIA 26, CSM I 211). Descartes clears this up in a letter to an unknown correspondent: “I make a distinction between modes strictly so called, and attributes, without which the thing of which they are attributes cannot be; or between the modes of things themselves and the modes of thinking” (AT 348–49, CSMK 279–80). He goes on to observe that the essence and **existence** of a triangle differ modally as thoughts but not in reality (cf. Nolan 1997).

Descartes frequently emphasizes that by making motion a mere mode of bodies he avoids any “action” or “**force**” that produces the motion (AT VIIIA 32, 54, 55; CSM I 216, 233, 234). This reductionist analysis has significant, and potentially problematic, implications for his **physics**. While explaining the modal distinction, Descartes notes that the motions of distinct things are really distinct

from one another since they “cannot be understood apart from the really distinct substances of which they are modes” (AT VIIIA 30, CSM I 214). This means that when Descartes speaks of motion as “something that is mutually transferred when collisions occur” (AT VIIIA 66, CSM I 243), this cannot be taken literally. He later concedes this point to **Henry More**: “You observe correctly that motion, being a mode of body cannot pass from one body to another” (AT V 404, CSMK 382). This is one reason why God is needed at the foundation of Cartesian physics: he produces and conserves not only a certain total quantity of motion but also “all the reciprocal impulses and transfers between them” (AT VIIIA 66, CSM I 243).

A more serious difficulty with treating motion as a mere mode involves Descartes’ apparent relationism. He defines motion “in the strict sense” as “the transfer of one piece of matter, or one body, from the vicinity of other bodies which are in immediate contact with it, and which are regarded as being at rest, to the vicinity of other bodies” (AT VIIIA 53, CSM I 233). But, as Descartes himself emphasized, transfer is a “reciprocal” notion: we can choose to regard either (or neither) of the contiguous bodies as being at rest. He concludes that strictly speaking in all such transfers “we should say that there is just as much motion in one body as in the other” (AT VIIIA 56, CSM I 235). But, as **Newton** (2004, 19) observed, this implies numerous absurdities, for example, that not even God could stop the motion of the earth while allowing its surrounding **vortex** to continue. As **Leibniz** (1989, 18) recognized, a pure relationist must dispense with the view that motion is an intrinsic mode of bodies: “If we consider what motion contains precisely and formally, that is, change of place, then motion is not something entirely real.” A final difficulty derives from Descartes’ use of relative motion to individuate bodies: “By ‘one body,’ or ‘part of matter,’ I here understand everything which is simultaneously transported” (AT VIIIA 54, CSM I 233). This seems to make motion, at least relative motion, an essential attribute of bodies rather than a contingent mode (see **individuation**).

See also Attribute; Distinction (Real, Modal, and Rational); Individuation; Leibniz, Gottfried; Newton, Isaac; More, Henry; Motion; Quality, Real; Shape; Substance

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GEOFFREY GORHAM

MORE, HENRY (1614–1687)

The Cambridge Platonist, More, was one of the most influential figures in the early reception of **Cartesianism** in England, as both admirer and critic of Descartes. He was one of the first to advocate the teaching of Descartes' philosophy in English universities and is credited with coining the term "Cartesianism." More's interest in Cartesian **philosophy** is first registered in his long poem, *Democritus platonissans* (1646). In 1648 he entered into **correspondence** with Descartes (1648–49), possibly at the instigation of Samuel Hartlib. He was attracted by Descartes' natural philosophy, which he regarded as the best account of the phenomena of nature in the post-Aristotelian context of the mid-seventeenth century. Much as he admired Descartes' natural philosophy, he did not accept Descartes' **physics** in every detail but sought to enlarge the metaphysical dimension of Cartesianism.

In his letters, he argues that that all **substance**, both corporeal and incorporeal, is extended and that God Himself is *res extensa*. Since both corporeal and incorporeal substance are extended, the operative distinction between them is solidity (or what he called impenetrability), bodies being extended and impenetrable, while incorporeal substance (soul or spirit) is extended and penetrable. He also took issue with Descartes over his denial of the possibility of a **vacuum**, rejecting final **causes**, and denial that **animals** have souls. He raised the problem of transmission of **motion** from one **body** to another, if motion like **shape** is merely a **mode** of body. He points up areas where Descartes is not fully self-consistent, or has dissembled his position, notably in positing the indefinite extent of the universe but not its infinity. He also criticized his account of refraction, and his vortical theory of celestial motions (see **vortex**). Descartes responded to More's letters in detail, though he evidently regarded More's arguments as too anthropomorphic for his liking.

Although he continued to express his admiration for Descartes, More became increasingly aware of the limitations of Cartesian physics, developing his criticisms

in his published writings, *An Antidote against Atheism* (1653), *Of the Immortality of the Soul* (1659), and in his apologetic *Epistola ... ad V. C.* (1662). More rejects all of Descartes' proofs of the **existence** of **God** apart from the **ontological argument**, claiming that the others are not such as would persuade atheists. He dubbed Cartesians "nullibists" (i.e., nowhere-ists), since they argued for the existence of the soul but failed to locate it adequately. Eventually More came to see Cartesianism as posing "ill consequence to religion" and, therefore, as offering succor to atheists, such as **Spinoza**. In his *Enchiridion metaphysicum*, More proposed his own hypothesis of spiritual causality – his Hylarchic Principle, or Spirit of Nature, first discussed in his *Of the Immortality of the Soul*, which he believed gave a more satisfactory **explanation** than Descartes of mind-body interaction and of phenomena (such as tidal movement) for which the mechanical physics of Descartes could not account. He added a number of *scholia*, to the Latin edition of his works (*Opera omnia* 1675–79), in order to underline the shortcomings of Cartesianism as he saw them. Thus, having initially done so much to promote Cartesianism, Henry More eventually became identified as an anti-Cartesian. His critique of Descartes was influential in the latter half of the seventeenth century, in the universities of England and Scotland, and with European anti-Cartesians, notably **Pierre Daniel Huet**.

See also Animal; Cartesianism; Cause; Extension; Huet, Pierre-Daniel; Human Being; Motion; Ontological Argument; Physics; Vacuum; Vortex

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SARAH HUTTON

MORIN, JEAN-BAPTISTE (1583–1656)

Morin was born in Villefranche-en-Beaujolais and died in Paris. After studying **philosophy** in Aix and receiving a doctorate from Avignon in 1613, he became physician and astrologer and, ultimately, professor of **mathematics** at the Collège de France (1629–56). Early on, Morin went to Hungary and Transylvania to inspect mines. As a result of his trip, he wrote a short treatise, *Nova Mundi sublunaris anatomia* (1619), in which he argued for a new theory of the earth's "anatomy." In 1623 he published *Astrologicarum domorum cabala detecta*, an argument for the twelve houses of the Zodiac based mainly on Cabalistic and numerological principles. Morin also made a name for himself with a number of astrological predictions, some of which were borne out.

In 1624 Morin distributed a pamphlet defending Aristotle against some atomist and alchemical theses. Though not a rigid Aristotelian, he also attacked the Copernican opinion of the earth's motion (*De Telluris motu*, 1631; *Responsio pro Telluris quiete*, 1634) (see **earth, motion of the**). He became involved in further polemics when he published his solution to the problem of determining longitude, rejected by Richelieu's experts. He also wrote circulars attacking **Pierre Gassendi**. Morin's principal work was *Astrologia Gallica* (1661), though he was also known for a short treatise on God, *Quod Deus sit* (1635), which consisted of a proof for the **existence of God** given in a geometrical fashion (using **definitions**, axioms, and theorems).

Descartes knew Morin, and they exchanged letters. Descartes sent a copy of the *Discourse on Method* to him, and this precipitated another exchange between them in which Morin articulated criticisms of Descartes' theory of **light**. After a few letters, however, Descartes cut off the **correspondence**. Descartes also read *Quod Deus sit* when **Mersenne** sent it to him, but indicated his dissatisfaction with the work in a letter written shortly before the publication of the *Meditations*: "I have read through Mr. Morin's booklet. Its chief defect is that he treats of the infinite everywhere as if his mind were above it and he could comprehend its properties. That is a common fault with nearly everyone.... And thus all that he says right up to the end is far removed from the geometrical evidence and certitude that he would seem to be promising at the beginning" (AT III 293–94, CSMK 171–72).

See also Light, Ontological Argument

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ROGER ARIEW

MOTION

Descartes' influential account of motion constitutes one of the central pillars of his natural philosophy and has provided the foundation for many later methods of understanding this most basic of phenomena, both among the Cartesians in the seventeenth century and in modern times. As a major advocate of the mechanical school

of natural philosophy, Descartes rejected the complex scheme of **substantial forms** that the Scholastics had employed to explain nature; rather, **bodies** and their various phenomena “can be explained without having to assume anything else ... in their matter but motion, size, **shape**, and the arrangement of their parts” (AT XI 26, CSMK 89). Moreover, unlike the Scholastics, whose intricate conception of motion embraced a wide variety of qualitative changes, such as generation and corruption, Descartes followed many of the other mechanical philosophers of the period by limiting motion (*motus*) to simply change of place. Descartes insists that all movement is “local movement, because I can conceive no other kind” (AT VIIIA 53, MM 50); and, in *The World*, he comments that the Aristotelian definition of motion (“as the actualization of a potential in so far as it is a potential”) is obscure (AT XI 39). From a metaphysical perspective, however, Descartes regards motion as a “**mode**” of **extension**, that is, as a way that extension manifests itself, or as a property of extension (*Principles* I.53; e.g., shape is mentioned as an additional mode of extension).

While the basic ingredients of Descartes’ theory of motion can be discerned in his early work *The World* (1633), his most exhaustive analysis of motion can be found in the *Principles of Philosophy* (1644), which is his most significant contribution to natural philosophy. In the *Principles*, he defines motion as “the transfer of one piece of matter or of one body, from the neighborhood of those bodies immediately contiguous to it and considered at rest, into the neighborhood of others” (AT VIIIA 53–54, MM 51). This account, which he refers to as the “proper” conception of motion, is also contrasted with a “common” understanding of motion. The proper way to understand the motion of a body is as a change of the neighborhood of contiguous bodies that surround the body, with the inner surface of these containing bodies (that border the contained body) named the “external place” of the contained body (see **place, external versus internal**). On the other hand, the common or ordinary conception of motion considers it to be merely “the action by which a body travels from one place to another” (AT VIIIA 53, MM 50), and which allows any reference frame or outside body to be used to measure the motion.

Hence, on the ordinary conception, a body can simultaneously partake in many motions relative to different reference bodies or viewpoints, as when a passenger on a ship views herself as at rest relative to the parts of the ship but moving relative to the shore. But, if the motion is viewed as a translation of its contiguous neighborhood, then a body can participate only in one motion, since the body must be either at rest in or in translation away from its contiguous neighborhood. Therefore, the troubling possibility that a body can partake in several different motions at the same time, with none judged to be the “true” motion, is dispelled if conceived according to the proper **definition** of motion. Part of the rationale for Descartes’ definition of motion, moreover, would seem to lie in its capacity to claim that the earth is properly at rest and thereby to avoid the church censorship that had earlier silenced **Galileo’s** espousal of a moving earth. That is, since

Descartes holds that the earth is at rest relative to its neighborhood of contiguous particles, despite the fact that the earth and its neighborhood are circling the sun in unison, the earth is at rest according to the proper definition, whereas it is only moving around the sun in the common or vulgar sense of motion (AT VIIIA 90) (see **earth, motion of the**).

However, since Descartes' definition of proper motion holds that the contiguous bodies are "considered at rest," this seems to imply that the decision to view these bodies at rest or in motion is arbitrary, as he indeed later admits: "We cannot conceive of the body AB being transported from the vicinity of the body CD without also understanding that the body CD is transported from the vicinity of the body AB" (AT VIIIA 55–56, MM 53). He concludes, therefore, that "all the real and positive properties which are in moving bodies, and by virtue of which we say they move, are also found in those [bodies] contiguous to them, even though we consider the second group to be at rest" (AT VIIIA 57, MM 54). For Descartes' contemporaries, and the succeeding generations of natural philosophers up to the present day, these last assertions would come to be seen as favoring a "relational" theory of motion: on the relational theory, since motion is just a relation among bodies, all that can be ascertained is just the relative change of position among bodies, and so there can be no one true account of which body or bodies actually moved or remained at rest given a change in position. Nevertheless, it is unclear if Descartes actually accepted a relational account of motion, for many aspects of his natural philosophy seem to undermine a commitment to relational motion.

A notable instance concerns the fourth and fifth collision rules, which detail the application of his third law of nature in the *Principles*: "The third law: that a body, upon coming in contact with a stronger one, loses none of its motion; but that, upon coming in contact with a weaker one, it loses as much as it transfers to that weaker body" (AT VIIIA 65, MM 61). In the fourth collision rule, Descartes concludes that a large stationary body remains at rest after the impact with a smaller moving body, with the smaller body simply reversing its path after the collision (AT VIIIA 68). In the fifth rule, on the other hand, a large moving body will move a smaller stationary object, "transferring to [the smaller body] as much of its motion as would permit the two to travel subsequently at the same speed" (AT VIIIA 69, MM 67). But, according to the relational theory of motion, rules four and five comprise the very same collision, since both concern a small and large body with the same relative motion prior to impact (i.e., there are only differences in motion among bodies on the relational theory, and no individual properties of motion), and so the outcomes should be the same. The fact that Descartes treats these two collision rules differently as regards their outcomes thus suggests either that he did not accept a thoroughgoing account of relational motion or, less plausibly, that he was unaware of the contradiction in his application of relational motion to these collision rules.

There are many other difficulties associated with Cartesian natural philosophy that involve motion and its central explanatory role. In particular, there appears to be a circularity problem as regards Descartes' definitions of body and motion, such that the definition of motion relies upon a prior understanding of body, and the definition of body presumes an understanding of motion. Descartes states that by "one body, or one part of matter, I here understand everything which is simultaneously transported" (AT VIIIa 53–54, MM 51), but, as just explained, motion is defined as the transference of a body from its contiguous neighborhood of bodies. A further difficulty pertains to Descartes' rejection of any bond among the constituent particles of a body, a bond that could be used to explain the solidity of the body. Rather, it is the relative rest of the constituent particles of the body that accounts for its solidity (AT VIIIa 72). But, since a body is defined as "everything which is simultaneously transported," it would seem to follow that a resting body cannot be differentiated from the contiguous matter that forms the external place of that resting body.

Leaving aside these metaphysical issues, Descartes' three **laws of nature** represent an important milestone for the understanding of bodily motion, since they would serve as the basis of **Newton's** own laws of motion. Descartes' first law (a version of the law of **inertia**) states "that each thing, as far as is in its power, always remains in the same state; and that consequently, when it is once moved, it always continues to move" (AT VIIIa 62, MM 59), while the second holds that "all movement is, of itself, along straight lines" (AT VIIIa 63, MM 60). Since motion and rest are deemed to be primitive or basic states of material bodies, Descartes' first two laws provide a theory of motion that differs significantly from the accounts offered by the earlier Scholastics, the latter employing a variety of "natural" motions as regards the four elements as well as "violent" motions that might be imposed on them. Whereas the Scholastics would assign a natural state of motion or rest to the same element depending on its place in the universe, for example, the element earth is at rest at the center of the universe, but in motion toward that place otherwise, Descartes' natural philosophy makes no such distinctions: all matter retains the same state of motion or rest, unless acted upon, and there are no natural places to which their motion is directed. Nevertheless, Descartes' conception of the natural states of motion falls short of the modern idea of inertia, since he regards motion and rest as opposite states, whereas the modern view reckons them to be the same state. As he argues, "because experience seems to have proved it to us on many occasions, we are still inclined to believe that all movements cease by virtue of their own nature, or that bodies have a tendency towards rest. Yet this is assuredly in complete contradiction to the laws of nature; for rest is the opposite of movement, and nothing moves by virtue of its own nature towards its opposite or own destruction" (AT VIIIa 62–63, MM 59).

The third law of nature, as mentioned earlier, holds that there is a conserved quantity of motion in the universe and that this “**force** must be measured not only by the size of the body in which it is, and by the surface which separates this body from those around it; but also by the speed and nature of its movement, and by the different ways in which bodies come in contact with one another” (AT VIII A 67, MM 63) (see **conservation of motion, principle of**). As one of the very first conservation laws in the history of physics, Descartes measures this force, roughly, as the product of the size and speed of bodies, with his set of seven collision rules specifying the application of the third law under idealized conditions. Although the content of Descartes’ laws of nature, collision rules, and conservation law would be replaced by later natural philosophers, their general methodological scheme would serve as the basis of modern physical theory.

See also Body; Conservation of Motion, Principle of; Earth, Motion of the; Explanation; Extension; Force and Determination; Inertia; Law of Nature; Physics; Place, External versus Internal; Scholasticism; Vortex

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EDWARD SLOWIK

MYDORGE, CLAUDE (1585–1647)

Mydorge was born in Paris to one of the wealthiest families in France. He was educated at the **Jesuit** College of La Flèche and subsequently trained as a lawyer, before embarking on a legal and administrative career. After serving as *conseiller* to the court of the Grand Châtelet, he became treasurer of the *généralité* of Amiens, the collector general being a direct agent of the king. Mydorge’s chosen employment allowed him sufficient time to combine public office with the life of a savant. Residing in what remained of the ancient Palais des Tournelles, he first met Descartes around 1625, becoming one of his most faithful friends and helping to establish his reputation

in Paris. The mathematician Claude Hardy, a leading figure in the scientific circles around **Mersenne**, **Roberval**, and Étienne Pascal, lodged with him while he was producing his edition of Euclid's *Elements*.

Mydorge shared with Descartes a strong interest in **optics** and the nature of vision. It is well known that in order to promote his friend's investigations on these topics, he commissioned the production of innumerable parabolic, hyperbolic, oval, and elliptic lenses, reputedly spending in excess of 100,000 écus on optical instruments over the years. Both men were interested particularly in refraction, and when Descartes, independently of Snell, discovered the law of refraction, he persuaded Mydorge to have a hyperbolic glass made in order to test his discovery. It is possible that Mydorge contributed to the results that Descartes achieved, although his approach to refraction differed fundamentally from the law published in *Dioptrics*, which employs the ratio of the sine of the angle of incidence to the sine of the angle of refraction.

Mydorge's first major work was the *Examen du livre des Récréations mathématiques*, published in 1630. As the title suggest, it was a work on recreational **mathematics** and was effectively a critique of Laurechon's book on the theme. However, it was through his work on conic sections that Mydorge made the greatest scientific impact. His motivation for these studies came from his investigations on catoptrics, the optics of mirrors. While employing ancient techniques in dealing with conics, he achieved considerable success in simplifying the proofs of Apollonius. His work contains the powerful idea of deforming figures, such as deforming a circle in order to form an ellipse. In 1631 he published *Prodromi catoptricarum et dioptricarum, sive conicorum libri duo*, which later, in 1641, was expanded into four volumes. As such it was inserted by Mersenne into his *Universae geometricae, mixtaeque mathematicae synopsis*, 1644.

Beyond mathematics, Mydorge also made contributions to astronomy and cartography, achieving the measurement of the latitude of Paris to a high degree of precision. In view of his expertise, he was naturally tasked, alongside Étienne Pascal and Hérigone, with judging Morin's proposed method for determining longitude. A source of moderation, Mydorge played a decisive role in reconciling Descartes and **Fermat** in 1638, following Fermat's criticism of the *Geometry* for failing to deal with the problem of maxima and minima. He died in Paris in 1647.

See also *Dioptrics*; Fermat, Pierre de; *Geometry*; Light; Mathematics; Mersenne, Marin; Optics

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PHILIP BEELEY

NATIVE INTELLIGENCE (*INGENIUM*)

Descartes' *ingenium*, corresponding to French *esprit* and usually translated "**mind**," is more accurately rendered as "native intelligence" or "native wit." It occurs in the correspondence with **Isaac Beckman** in 1619 and chiefly and frequently in the unfinished *Rules for the Direction of the Mind*, which begins with the statement that "the aim of studies ought to be the direction of *ingenium* so that it brings forth solid and true **judgments** about all things that occur" (AT X 359, CSM I 9). This first Cartesian treatment of **method** is an account of *ingenium*'s proper employment.

Ancient and Renaissance rhetoric regarded *ingenium* as a disposition essential to oratorical and poetic invention. Early medieval Scholastics considered it, alongside **memory**, as necessary for intensive study and meditation. The early seventeenth-century philosophical lexicographer Rudolphus Goclenius wrote that this "power of successfully and easily discovering and contriving in **human beings**" depended on both **body** and mind, on "the constitution of the organs, and on the auxiliary faculties, like the phantasia" (Sepper 1996, 90).

Descartes' *Rules* is indebted to this psychophysiological tradition. The chief aids to **intellect** are common sensation (see **common sense**), memory, and **imagination**. They are the various ways in which the knowing power (*vis cognoscens*) acts in and through the organ of *phantasia* (which eventually becomes the "little gland," the **pineal gland**, of the *Treatise on Man*). When properly regulated, they enable one to intuit simple things distinctly, to combine complexes correctly, and to compare all things human powers can access (see **simple nature**). Rule 12 defines *ingenium* as the knowing power insofar as it "forms new ideas in the phantasia, or concentrates on those already formed" (AT X 416, CSM I 42). Since "**idea**" in the *Rules* is used for corporeal and mathematical images, *ingenium* amounts to the active, inventive power of forming and concentrating on images. It is the ultimate source of Descartes' analytic **geometry**, which dynamically generates new figures from existing ones by imaginative manipulations that are tracked and anticipated using algebraic equations. Although the later Descartes' interest in the term *ingenium* fades (it is partially absorbed into concepts like *bona mens* and *esprit*), the essence of its practice, process, and regulation lives on in his concern with method, especially mathematical method.

See also Common Sense, Imagination, Intellect, Memory, Method, Mind, *Rules for the Direction of the Mind*

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NATURE

Descartes used the term “nature” (Latin *natura*, French *nature*) with several meanings, each of which has some relation to previously established usage. The term “nature” might mean “nature in general,” which Descartes glossed as “**God** himself,” or “the coordination of created things instituted by God” (AT VII 80, Heffernan 199–201). **Laws of nature** belong here. In this usage, nature when taken as a whole is an ordered system, but it also consists in the “coordination” of individual kinds of thing, such as the **human being** as a composite of **mind** and **body** in which a system of relations has been established between brain states and sensations (see **extrinsic denomination**). Things “instituted” or “ordained” by nature belong here (AT VI 130, CSM I 167). Further, in this first sense a quality or ability may “naturally” belong to something, such as the natural light or the legitimate teachings of nature (AT VII 80–81, CSM I 56). In a second usage, “nature” is equivalent to **essence**. It serves as an abstract term for the principal **attribute** of a **substance**, the “nature and essence” of that substance (AT VIIIA 25, CSM I 210). Related notions include **simple natures** and **true and immutable natures**. There is a third usage that arises in Descartes’ philosophy because of his reorganization of finite substances into two kinds, mind and matter, which necessitated a replacement notion for **substantial forms** of the various natural kinds, a replacement that construes kinds of material things as possessing only properties permitted in an exclusively corporeal substance. This third notion concerns characteristics of material things stemming from their organization. The most extensive use of this notion occurs in the *Principles of Philosophy*, but is also frequently found in the *Discourse on the Method*, the *Dioptrics*, the *Meteorology*, *The World* (or *Treatise on Light*), and the *Treatise on Man*.

It was common in the Aristotelian philosophy of Descartes’ time to speak of the nature of a thing as the expression of its essence through some characteristic activity or operation (Gracia 1982, 233–34). In this regard, things below the sphere of the moon have a substantial form that constitutes the essence of their substance and which is a principle of **motion** or change. In living things, it is a principle of growth and development. By eliminating substantial forms from purely corporeal objects, Descartes made it no longer possible for each kind of object to have its own substantial nature or essence. But Descartes nonetheless acknowledged distinct kinds of things in nature, such as air, water, quicksilver, salt, plants, and animals. In his scheme, these things behave the way they do because of the organization of their material parts. These organizations then constitute the “natures” of the various kinds of things.

In a characteristically clever bit of repurposing of traditional philosophical vocabulary, Descartes explained this notion of the natures of things in *Principles* II:

Any variation in matter or diversity in its many forms depends on motion.
This seems to have been widely recognized by philosophers, since they have

stated that nature is the principle of motion and rest. And what they meant by “nature” in this context is what causes all corporeal things to take on the characteristics of which we are aware in experience. (AT VIIIA 53, CSM I 232–33)

In an Aristotelian context, the phrase “motion and rest” means alteration and, more specifically, alteration in accordance with a characteristic end. The alteration might be purely qualitative and in that regard need not involve locomotion. Descartes in this passage is speaking of locomotion or change of place of the parts of things. The material constitution of things and the motions of the parts account for their characteristic behaviors, now understood mechanistically and in terms of one kind of substance: extended material substance. In this same passage, he had just said:

The matter existing in the entire universe is one and the same, and it is always recognized as matter simply in virtue of its being extended. All the properties which we clearly perceive in it are reducible to its divisibility and consequent mobility in respect of its parts. (AT VIIIA 52, CSM I 232)

Given that all bodies have the same essence, differences between them arise from the arrangement and motions of their parts. Indeed, the postil to this article announces that the diversity of the “forms” of matter will be explained in this way, by **shape** and motion of particles, and one would be correct to see here the repurposing of the term “form” with a corpuscular meaning.

Descartes’ appropriation of the term “nature” in this passage is not an isolated bit of word play. In the subsequent parts of the *Principles*, he introduces the “natures” of many things by describing their characteristic organizations and motions of their parts. In part III, he describes the “nature of the first two elements” (AT VIIIA 142, MM 132) – that is, of the minute corpuscles of the **plenum** and the round corpuscles of the second **element**, which account for **light** – in terms of their shape and motion. This accords with the *Dioptrics*, where he spoke of the “nature” of light (AT VI 103, CSM I 162) and the corporeal “natures” of various colors in terms of configurations and motions of particles (AT VI 92, CSM I 156). In *Principles* IV, he endeavors to explain the “true natures of things,” utilizing the “false hypothesis” that they have arisen out of a chaos of matter through interactions that follow the laws of nature (AT VIIIA 203, CSM I 267). (Descartes endorses special creation but lavishes most of his attention on the hypothesis that the organization of the world into star systems, planets, minerals, and other elements can be explained as arising out of a chaos of matter.) This effort consists mainly of describing the various ways in which the larger, irregularly shaped particles of the third element come together to form the earth and its parts and the various kinds of things on the earth, mainly mineral in the extant *Principles* (the intended parts of that work on plants and animals having been abandoned). He explains the “natures” of air, water, of the earth’s interior, of quicksilver, of fire, and of various minerals and metals,

whether he repeats the word “nature” or not (AT VIIIA 231, 232, 238, 239, 249; CSM I 271–73).

The first and third meanings come together when Descartes speaks of the “natures” of organic bodies, as having arisen as part of the “order of nature” from the chaos (or as having been created). Descartes applied the term “nature” in the third sense not only to minerals but also to blood and other parts of the animal (AT VI 50, CSM I 136; AT XI 284) and, more generally, to plants and animals (AT IXB 14, CSM I 186). Descartes writes to **Mersenne** that “the number and the orderly arrangement of the nerves, veins, bones and other parts of an animal do not show that nature is insufficient to form them” (AT II 525, CSMK 134). “Nature” in this passage means the general system of nature and the things that can arise simply through the patterns of interaction of material corpuscles (without special creation). Thus, nature (first sense) might produce organic natures (third sense).

See also Body; Essence; Extrinsic Denomination; Form, Substantial; Law of Nature; Motion; Simple Nature; True and Immutable Nature

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GARY HATFIELD

NEWTON, ISAAC (1642–1727)

Newton was born into a reasonably humble family in Lincolnshire, England, on Christmas Day, 1642. Although his mother was the daughter of a relatively prosperous

man, Newton was the first in his family to obtain any education. After finishing his studies as an undergraduate at Trinity College, Cambridge, in 1665, Newton did considerable work in **mathematics**, rising to become the second Lucasian Professor of Mathematics at the University of Cambridge in 1669 (the first holder of the chair was his teacher, Isaac Barrow). In the early stage of his career, the 1670s, he made important contributions to experimental **optics**, and during the 1680s, Newton made huge advances in natural **philosophy**, culminating in the publication of his magnum opus, *Philosophiae naturalis principia mathematica*. Newton gave his treatise this title to signify his dissatisfaction with Descartes' *Principles of Philosophy*, which did not live up to the Cartesian program of using mathematics to understand and explain natural phenomena. During the 1690s, Newton befriended **John Locke** and had several important philosophical exchanges with various figures, including **G. W. Leibniz** (the German philosopher and mathematician) and Richard Bentley (a London theologian). By the turn of the new century, "Newtonianism" was a powerful intellectual force in England and was soon to become a major competitor to Cartesian **metaphysics** and natural philosophy on the Continent. Newton and his defenders, especially the theologian Samuel Clarke, engaged in an extended philosophical and political debate with the other great critic of – and rival to – Descartes in this period, Leibniz. This debate culminated in the Leibniz-Clarke correspondence (1715–16), perhaps the most influential philosophical exchange of the eighteenth century.

When Newton was young, he learned about the latest "modern" geometrical techniques from Van Schooten's Latin edition of Descartes' *Geometry*; he read the *Meditations* and the *Principles* while he was still an undergraduate student at Trinity College; and before his public and vociferous debate with Leibniz and his followers in the early eighteenth century, he considered Descartes to be his most significant predecessor in natural philosophy. Newton devoted the bulk of a long unpublished manuscript, now known as *De Gravitatione*, to refuting Descartes' understanding of space, time, and **motion**, along with his conception of the mind-body relation and of the divine. Newton's rejection of Cartesian metaphysics was heavily influenced by the views of the Cambridge Platonist **Henry More**, whom he knew personally. Like More, he took **dualism** to render the mind-body union unintelligible, believing instead that all **substances**, including the **mind** (and even **God**), are spatially located (see **human being**). This enables one to conceive of immaterial substances as bearing a causal influence on material ones. He maintained this view many years later in the famous General Scholium to the *Principia* (1713), which was written to rebut Leibniz's criticisms, but which still reflected his original break with Descartes. Newton's arguments against Cartesian natural philosophy were all his own. He contended in particular that Descartes' three **laws of nature** – articulated in *Principles* II – present a conception of **motion** that is incompatible with the view of "true" motion that Descartes defines, in part on metaphysical grounds. For

Newton, one cannot square the view that the true motion of a **body** is a function of its relations to its neighbors with the law of **inertia**. With his famous bucket experiment in the Scholium to the *Principia*, Newton suggests – in connection with this criticism – that we should not conceive of a body's true motion as a change in its relations with other bodies, contra Descartes. Here we find a principal motivation for Newton's view that true motion consists in a change of a body's location within space itself (i.e., absolute space). So Newton's view of absolute space has its origin in his rejection of Descartes' ideas.

See also Bacon, Francis; Boyle, Robert; Experiment; Law of Nature; Leibniz, Gottfried Wilhelm; Locke, John; Method; Motion; Physics

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ANDREW JANIAC

NOËL, ÉTIENNE (1581–1659)

Noël was born in Lorraine. He taught at La Flèche, where he later spent his last days, and was later rector of the **Jesuit** Collège de Clermont in Paris, when, in 1646, he sent to Descartes copies of his *Aphorismi physici*, and his *Flamma, seu tractatus de sole ut flamma est, ejusque pabulo*, along with assurances of friendship and esteem. He was an Aristotelian but of the *novantique* sort that tried to find common ground

between the new **philosophy** and the old. In particular, he agreed with Descartes' views on barometric phenomena; he debated with **Pascal** the possibility of a **vacuum**, defending the view of both Descartes and the Aristotelians that there is none.

See also Jesuit; Pascal, Blaise; Vacuum

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THOMAS M. LENNON

OBJECTIONS AND REPLIES

Descartes presented the *Meditations* to a select group of scholars before publication so that their comments and his replies would be issued with the work in a single volume. **Marin Mersenne**, Descartes' primary correspondent, was initially instructed to submit it to "three or four" trusted theologians only. Their approval would be enough to dedicate the book to the Sorbonne, "in order to ask them to be my protectors in the cause of **God**" (AT III 183–85). But the project grew into something more ambitious. Initially, Descartes asked his friends J. A. Bannius and A. A. Bloemaert to write some objections; they, in turn, asked the Dutch priest **Johannes Caterus** to do so. Caterus's First Set of Objections, together with Descartes' *Replies* and the manuscript of the *Meditations*, was then sent to France to be printed, with Descartes leaving Mersenne to organize the rest and telling him that he would be "glad if people make as many objections as possible and the strongest they can find" (AT III 297). Descartes had already tried to promote his works by making them a focus of discussion; he previously requested objections to the *Discourse* to be sent to his publisher, promising to have them published with his response (AT VI 75). This time he was collecting objections before publication. Mersenne obtained five more sets, making six altogether in the first edition; a seventh set followed in the second edition of 1642. In a somewhat rare show of modesty, Descartes decided that his own responses should be called "Replies to the Objections" rather than "Solutions" "so as to leave the reader to judge whether they provide solutions or not" (AT III 340, CSMK 170).

The objectors are as follows:

1. Caterus
2. "Theologians and philosophers," represented as "collected by Mersenne"
3. **Thomas Hobbes**, later described as "a famous English philosopher"
4. **Antoine Arnauld**, a theology doctorate student at the Sorbonne, whose objections are addressed to Mersenne as intermediary
5. **Pierre Gassendi**, philosopher and historian
6. A group described as "various theologians and philosophers," once more collected by Mersenne, together with an appendix containing the arguments of "a group of philosophers and geometers"
7. The **Jesuit** mathematician **Pierre Bourdin**

Descartes became very angry with Gassendi when the latter published a separate edition with rejoinders; so, for the 1647 French edition of the *Meditations*, Descartes asked his translator **Claude Clerselier** to omit Gassendi's objections and to substitute instead a letter produced by his friends, in which he would answer a selection of Gassendi's strongest arguments.

Descartes received Bourdin's voluminous packet of objections in January 1642, when his Dutch publisher Elsevier was already printing the second edition of the *Meditations*. So Descartes had them printed in the second edition, with his replies scattered within the objections. Descartes also added a long letter to the provincial of the Jesuits in the Île de France, Jacques Dinet, in which he complained about Bourdin and suggested that the Jesuit order should dissociate itself from him. It is generally agreed that the Fourth Set of Objections and Replies are the best. Arnauld pressed Descartes hard on issues such as the argument in the Sixth Meditation for the real distinction of mind and body, the concept of material falsity, and what has come to be known as the "Cartesian Circle." But Arnauld was a sympathetic critic who, in Descartes' words, "had grasped the sense of what he had written better than anyone" (AT III 331, CSMK 175). As a result, Descartes took Arnauld's objections very seriously and penned thoughtful responses; the Fourth Replies contrasts noticeably with his often curt and dismissive remarks to Hobbes and Gassendi, who were unsympathetic readers. Although of unequal quality, the *Objections and Replies* are an important philosophical document, often clarifying points that remain implicit or obscure in the *Meditations*. Eventually, the *Objections and Replies* were translated into French by Clerselier and published in Paris in 1647.

It is clear that Descartes understood that he was making changes to the *Meditations* in the *Objections and Replies* and that he wanted others to know that he was doing so. After receiving Arnauld's objections to the *Meditations*, he wrote to Mersenne:

I am sending you at last my reply to Arnauld's objections, and I ask you to change the following things in my *Metaphysics* [Descartes' title for the *Meditations* prior to publication], thus letting it be known in this way that I have deferred to his judgment, and so that others, seeing how ready I am to follow his advice, may tell me more frankly what reasons they have for disagreeing with me, if they have any, and may be less stubborn in wanting to oppose me without reason. (AT III 334, CSMK 175)

He then proceeded to list six separate corrections, which he insisted should be put between brackets "so that it can be seen that they have been added" (AT III 335, CSMK 175). The requested corrections were indeed accomplished, though, despite Descartes' request, they were not inserted between brackets.

The intended bracketed changes by Descartes were minor, but were in effect *corrections* to the *Meditations* and intended to be displayed as such. Other changes were not so minor; some of them were acknowledged as changes and others not. One does not have to delve too deeply into the *Objections and Replies* to understand that some central Cartesian doctrines found there, such as God as "positive" **cause** of himself (*causa sui*) and God's free creation of the **eternal truths**, do not occur

explicitly in the *Meditations*. Jean-Marie Beyssade has tracked many additions, corrections, and changes to the doctrine of the *Meditations* brought about by the *Replies* to the *Objections*. As additions, Beyssade lists what he calls “fragments of theology,” such as the pages on the Eucharist in the *Fourth Replies*, and “fragments of philosophy,” such as the developments concerning God’s freedom and the creation of the eternal truths in the *Sixth Replies*. He mentions as well the doctrine of God as self-cause in the *First Replies* to Caterus and quotes a passage about it in which Descartes himself announces that he is adding something new: “In fact, I will also add here something I have not put in writing before, namely, that it is not even a secondary cause at which one arrives, but certainly that cause in which there is enough power to conserve something existing outside it and *a fortiori* conserves itself by its power, and thus is derived from itself” (AT VII 111, CSM II 80; Beyssade 1994, 33–34).

While additions are frequent, corrections are rare. Other than those referred to already, Beyssade (1994, 34–36) cites an interesting case of successive corrections within the *Objections and Replies* concerning the doctrine of God as self-cause. Arnauld criticized a wording of the First Replies that Descartes had appended to the *Meditations* with Caterus’s First Objections before having Mersenne distribute the set to others for further objections. A letter to Mersenne shows Descartes asking him to correct a text of the First Replies, which he indicates was already corrected on the initial copy (AT III 329); he then tells Mersenne which text to suppress and which to substitute. And he adds:

But please correct it in all the copies in such a way that none will be able to read or decipher the words.... For many people are more curious to read and examine words that have been erased than any others, so as to see how the author thinks he has gone wrong, and to discover there some grounds for objections, attacking him in the place which he himself judged to be the weakest. (AT III 330, CSM II 174)

Descartes speculates that the obvious erasure is why Arnauld paid so much attention to the question of God as self-cause: “I remember that my first draft of this passage was too crude; but in the later version I amended and refined it to such an extent that, had he merely read the corrections, without stopping to read the words that were crossed through, he would perhaps have found nothing at all to say” (ibid.). Thus Mersenne dutifully corrected for a second time a passage Descartes corrected once before, but this time in such a way that the act of correction would not be so obvious.

Beyssade (1994, 36) relates other interesting items in the broader category of changes. He refers to the synthetic exposition of the *Meditations* in the *Second Replies* as a substantial change from its canonical analytic exposition. Mersenne had asked

Descartes to set out the argument of the *Meditations* in geometrical fashion (AT VII 128, CSM II 92). Descartes responds that he had already done so, drawing a distinction between the order and the mode of demonstration, in the geometrical style of writing, and then further distinguishing the mode of demonstration into one that proceeds by way of **analysis** and the other **synthesis** (AT VII 155–56, CSM II 110–11). Hence, according to Descartes, the *Meditations* was written as an analytical exposition but could be produced as a synthetic exposition, which is what Descartes begins to provide in the **Geometrical Exposition**, appended to the *Second Replies* (AT VII 160–71, CSM II 113–20). The synthetic exposition, Descartes reminds us, is not as satisfactory as the analytic one, because “it does not satisfy the **minds** of those who desire to learn, since it does not teach the way in which the thing was discovered” (AT VII 156, CSM II 111).

Beyssade also wonders whether the version of the **ontological argument** that Descartes provides for Caterus in the First Replies is the same as the one given in the Fifth Meditation. Descartes understands that he introduced a change but explains the matter thus: “All of these points are readily apparent to one who pays careful attention, and they differ from what I have previously written only in the manner of their explanation, which I have deliberately altered so that I might suit a wide variety of minds” (AT VII 120, CSM II 85).

See also Analysis versus Synthesis; Arnauld, Antoine; Bourdin, Pierre; Caterus, Johannes; Cause; Circle, Cartesian; Dinet, Jacques; Falsity, Material; Gassendi, Pierre; Geometrical Exposition; God; Hobbes, Thomas; *Meditations on First Philosophy*; Mersenne, Marin; Ontological Argument

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ROGER ARIEW

ONTOLOGICAL ARGUMENT

Kant called “ontological” the argument that, deducing **God’s existence** from his **definition**, aims to turn the sentence “God exists” into a logical truth. Anselm of

Canterbury first devised this kind of argument in the eleventh century; yet, Kant referred to Descartes' formulation of it, which appears in the *Discourse on Method*, *Meditations on First Philosophy*, and *Principles of Philosophy*. In Descartes' time, the argument that was intended to prove God's existence from his definition was classified among *a priori* arguments, that is, among arguments that assume as a premise the **essence** of the being whose properties they attempt to deduce. Kant called it "ontological" precisely because it assumes as a premise what a being is. The *a priori* proof is placed in different positions among the proofs of God's existence in Descartes' works: it is the third proof in the *Discourse* and *Meditations*; it is the first one in the *Principles*.

Descartes often compares the *a priori* proof of God's existence to a mathematical one and, in the Fifth Meditation, adds a discussion of the essences of material things, including geometrical objects. There is a double affinity between the *a priori* proof of God's existence and a mathematical demonstration. First, the conclusion of each such argument cannot be denied without contradiction. Second, each argument takes as its major premise a definition that, according to Descartes, picks out a "**true and immutable nature**," which is represented by an innate **idea**.

The innateness of the idea of God is crucial to Descartes' attempts to validate the argument. Imposing their content on the mind, innate ideas cannot be modified by the will. This feature shows that innate ideas individuate essences that have a real being out of the mind, that is, what an innate idea represents is never "a mere nothing" (AT VII 65, CSM II 45). Thus, if the idea of God can be proved to be innate, it represents an essence that is fully real and not just mental. The standard charge against the proof – that it makes an illicit logical leap from the mental world of concepts to the extramental realm of things – would not be defensible, and the proof would correctly conclude from the existence contained in the idea of God to God's existence. On the other hand, if God's idea were "factitious," that is, an arbitrary product of thought, the *a priori* proof would be subject to the criticism that it illegitimately transforms a purely mental content into a real one.

This feature of the proof is stressed in the first version of the argument (version A) that is presented in the Fifth Meditation, the First and Second Replies (AT VII 115–16, 149–50 and 166–67; CSM II 82–83, 106–7, 117), and in the *Principles* (AT VIIIA 10, CSM I 197–98). It can be summarized as follows:

1. Whatever I perceive to be contained in the nature of a thing is true of that thing.
2. Existence is necessarily contained in the nature of God.
3. Therefore, God exists.

In the Second Replies, Descartes clarifies that this formulation of the proof applies to every demonstration concerning the nature of a thing. He offers a parallel proof for one of the properties of a triangle, as follows:

1. Whatever I perceive to be contained in the nature of something is true of that thing.
2. The sum of the three angles equal to 180 degrees is necessarily contained in the nature of the rectilinear triangle.
3. Therefore the sum of the angles of the triangles equal to 180° is true of the rectilinear triangle.

Version A is a sort of “meta-proof” of God’s existence, or of the sum of the angles of a triangle. In fact, that existence is contained in the idea of God or that the sum of the angles is equal to 180 degrees is assumed as true in the second premise of each argument, and version A takes as legitimate the inference from what is necessarily contained in the idea of a true essence to what is true of the thing corresponding to this essence. Consequently, the soundness of version A of the proof depends on the soundness of the second premise, that is, on the fact that existence is necessarily contained in the essence of God and is not attributed to God by an arbitrary act of the human mind.

The justification of premise 2 may be presented as an independent proof of God existence. In fact, in the Fifth Meditation premise 2 of version A is justified by a second version of the argument, starting from the definition of God as the most perfect being (version A¹):

1. God is the supremely perfect being.
2. Existence is a perfection.
3. Therefore, God exists.

Hence, God’s existence could not be denied without contradiction, and this is the reason why necessary existence would pertain to God and not to finite beings. Here Descartes assumes as evident that existence is a perfection (or predicate), after **Gassendi** (see AT VII 323; AT VII 382–83; CSM II 224–25, 262–63), Hume, and Kant each contested this assumption.

In the **Geometrical Exposition**, appended to the Second Replies, premise 2 of version A is presented as axiomatic (axiom X). In fact, thanks to its simplicity, the proof that existence is necessarily contained in the nature of God may easily be reduced to an intuition (AT VII 163–64, CSM II 115). Nevertheless, Descartes claims that it is a “wholly perfect” demonstration even according to Aristotle, since it uses the true definition of God as a *terminus medius* (middle term). As such, it pertains to the kind of **sylogisms** that Aristotle classified as “scientific” (AT III 383 and 395–96; CSMK 184, 186–87).

Descartes relies on the fact that the idea of God, being innate, represents a real essence to defend his proof against the first objector to the *Meditations*, the Dutch theologian **Caterus**. Caterus extends **Aquinas**'s criticism of the ontological argument to Descartes', blaming him precisely for mistaking a mental existence for a real one. Descartes replies that he agrees with Aquinas's criticism but that his proof differs from that of Anselm. The latter assumes as its premise a nominal definition of God – what everybody understands by the name “God” – and therefore it can conclude only that the name “God” involves existence in its meaning, rather than that God really exists. By contrast, Descartes' proof assumes as its premise the real definition of God as expressed by an innate idea of him (AT VII 115–16, CSM II 82–83). Descartes' problem is whether the definition of God as the most perfect being picks out a real or “true and immutable nature,” that is, whether the idea of God is innate. If this is the case, the objection is easily dispatched.

In the Fifth Meditation, Descartes introduces a criterion for innateness, namely, that the properties deduced from a nature or essence are not explicitly included in its definition. In the definition of a triangle, the sum of the angles equal to 180 degrees is not mentioned, so the demonstration of this property shows at the same time that the idea of a triangle is an innate one. Analogously, in the definition of God as the most perfect being, existence is not named, so his existence is validly deduced, and the idea of God is proved to be innate. But the two cases are not strictly analogous. In fact, in the definition of God as the most perfect being, the perfection of existence is already included under the general rubric “supremely perfect being,” and if existence is already included in God's definition, the proof that existence is necessarily included in the nature of God begs the question, that is, it aims at proving something that it assumes from the beginning. Therefore, the proof would show neither that existence pertains to God, by nature, nor that God's idea is innate, as it contends. In the Fifth Objections, Gassendi accuses Descartes of this fallacy in proving God's existence from the definition of “the most perfect being.” In his reply, Descartes limits himself to the strict analogy between the *a priori* proof of God's existence and a mathematical proof (AT VII 383, CSM II 263). By contrast, in his replies to Caterus, Descartes recognizes that the problem of proving that God's definition as the most perfect being corresponds to a real nature in which existence is necessarily included “isn't a minor difficulty” (AT VII 116, CSM II 83).

In order to demonstrate that the idea of God is innate and thus that existence is contained in the essence of God, Descartes formulates a new version of the *a priori* proof (version B). Descartes tries to reinforce the **analogy** between the definition of God and the definitions assumed as premises in mathematical proofs, and between the *a priori* proof of God's existence and mathematical proofs. Actually, mathematical proofs assume a definition – for instance, that of a geometrical **shape** – and, together with various postulates, derive from it further properties. Analogously, Descartes modifies his definition of God: God is defined as a “supremely powerful

being” rather than as the most perfect one. Infinite power involves existence neither implicitly nor explicitly, but existence can be derived from it using an axiom, namely, “What can exist by its own power always exists.” The *a priori* proof is hence reformulated as follows in the First Replies:

1. God is the supremely powerful being.
2. A supremely powerful being can exist by his own power.
3. What can exist by its own power always exists.
4. Therefore, God exists. (AT VII 119, CSM II 85)

This reformulation of the ontological argument proves that existence is necessarily included in the idea of God and that the idea of God is not made up arbitrarily. As a matter of fact, the problem of proving that the idea of God is innate coincides with the problem of the soundness of the proof that existence is necessarily contained in his essence, that is, of the soundness of the proof of premise 2 in version A.

The version of *a priori* proof derived from God’s omnipotence has been judged sounder than that deriving from perfection, because it does not presuppose that existence is a predicate (Henrich 1967). But, in fact, the proof claims that God’s power, as an object of thought, can produce an effect outside the mind; hence, it is an even better instance of the fallacy of making a logical leap from the mental to the extramental.

The new formulation of the *a priori* proof exploits one of the most relevant innovations that Descartes introduces in rational theology – the claim that God *causes* his own existence. Scholastic theology admitted that God has to be considered a being *a se*, meaning an uncaused being, and regarded it as contradictory to say that any being caused its own existence. Descartes proposes, by contrast, a positive reading of the being *a se* – God is *causa sui* – and helped himself to this reading in the second **cosmological argument** for God’s existence in the Third Meditation (see **cause** and **God**). This proof holds that in the course of investigating what causes my existence as a thinking thing, one arrives at a first cause powerful enough to give itself existence and all the perfections the idea of God contains, that is, a being that is the efficient cause of its own existence and, because of this, is a supremely perfect being. Facing the heated criticism by Caterus and later by **Arnauld**, in the First and Fourth Objections to the *Meditations*, Descartes upheld the notion of *causa sui*, maintaining that only on this notion joined with God’s idea is it possible to prove not only that there is a first cause starting from the effects but also that this first cause is a supremely powerful being, and hence is God (AT VII 239, CSM II 167). Descartes also argued that God has to be understood not as an efficient but as a formal cause of himself, as is usual in mathematics, when from the premises (formal cause) are derived its consequences: God is *causa sui* in the sense that his essence implies existence (AT VII 242, CSM II 168–69). In this way, the *a posteriori* proof infers the

existence of a being whose essence implies existence, that is, a being whose existence is deducible from its true definition. In this way, the *a posteriori* proof, which the Scholastic tradition had always opposed to the *a priori* proof, further legitimates the *a priori* proof. The radical change in the *a posteriori* proof was acknowledged by those philosophers who later elaborated a philosophical theology, from **Leibniz** to Wolff, and even by the philosophers critical of such a theology, like Hume. Indeed, in the *Dialogues on Natural Religion* Hume refers to the cosmological proof as an *a priori* argument, even though the proof in question seeks the cause of finite beings. Later, Kant claimed that the ontological argument is the only one that rational theology can use to prove God's existence, since all other proofs, most notably, the cosmological argument, merge into that proof. Kant's claim is intelligible only in light of Descartes' modifications of *a posteriori* arguments (see **cosmological argument**).

See also Cause, Cosmological Argument, Definition, Essence, Existence, God, Idea, True and Immutable Nature

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OPTICS

Descartes' work on optics spanned his entire career and represents a fascinating area of inquiry. His interest in the study of **light** is already on display in an intriguing study of refraction from his early notebook, known as *Private Thoughts*, dating from 1619 to 1621 (AT X 242–43). Optics figures centrally in Descartes' *The World (or Treatise on Light)*, written between 1629 and 1633, as well as, of course, in his *Dioptrics* (1637). It also, however, plays important roles in the three essays published together with the *Dioptrics*, namely, the *Discourse on Method*, the *Geometry*, and the *Meteors*, and many of Descartes' conclusions concerning light from these earlier works persist with little substantive modification into the *Principles of Philosophy* (1644). In what follows, we look in a brief and general way at Descartes' understanding of light, his derivations of the two central laws of geometrical optics, and a sampling of the optical phenomena he sought to explain. We will conclude by noting a few of the many ways in which Descartes' efforts in optics prompted – through both agreement and dissent – further developments in the history of optics.

Descartes was a famously systematic philosopher, and his thinking about optics is deeply enmeshed with his more general mechanistic **physics** and **cosmology**. In the sixth chapter of *The Treatise on Light*, he asks his readers to imagine a new world “very easy to know, but nevertheless similar to ours,” consisting of an indefinite space filled everywhere with “real, perfectly solid” matter, divisible “into as many parts and shapes as we can imagine” (AT XI 9, G 21, n. 40) (AT XI 33–34, G 22–23). Of this world he postulates that “from the first instant of creation,” **God** “causes some [parts] to start moving in one direction and others in another, some faster and others slower” and that subsequently “he causes them to continue moving thereafter in accordance with the ordinary **laws of nature**” (AT XI 34, G 23). The laws of nature, Descartes suggests, in turn sort the world into three **elements**: a maximally fine element of fire, a coarser yet still “very subtle” element of air, and a relatively gross element of earth “whose parts have little or no **motion**” relative to one another (AT XI 24–25; G 17–18). The sun, fixed stars, and fire are constituted primarily by the first element and are responsible for the production of light. The earth, planets, and comets are constituted by the third element and are responsible for the reflection and refraction of light. Finally, the heavens are constituted by the second element of matter and make possible the transmission of light from illuminated bodies, such as the sun and stars, to terrestrial bodies, such as the earth and human perceivers.

Against this mechanistic background, Descartes identifies light with a tendency to motion caused by luminous bodies (AT VIIIA 108, CSM I 259). In explicating this suggestion, he repeatedly invokes an **analogy** with the supposed tendency or *conatus* of a stone in a sling to recede from the center point around which it is rotated (AT

XI 43–44, G 29). Importantly, for Descartes, this centrifugal *conatus* is not to be confused with any actual motion away from a center point. Indeed, just as the felt outward tension in a rotating sling is possible only as long as the stone is not released, so too the centrifugal *conatus* that Descartes identifies with light is possible only as long as the bodies of the relevant transparent medium are constrained in the radial direction in a state of static equilibrium (Shapiro 1974, 248). In explaining the nature of light, Descartes further insists that light must be propagated *instantaneously*. In support of this assumption – embraced before him by the likes of Roger Bacon, Grosseteste, Witelo, and **Kepler** – Descartes famously argues that “the action of light” may “pass from the heavens to the earth in the same way” as “the movement or resistance of the bodies encountered by a blind man passes to his hand by means of his stick,” adding (rashly in hindsight) that “if this could be proved false, I should be ready to confess that I know absolutely nothing in philosophy” (AT VI 84, CSM I 153; AT I 308, CSMK 46). Finally, Descartes adds that light itself is propagated along straight lines, even if, as is likely the case, “the parts of the second element that serve to transmit this action – that is, light – can almost never be placed so directly one on the other that they make exactly straight lines” themselves (AT XI 100, G 64). In defense of this suggestion, Descartes once again makes adroit use of mechanistic **analogies**. In one such analogy, he argues that light may be transmitted linearly through a disordered **plenum** in much the same way as a person might transmit a perpendicular force by pushing downward on a convoluted stick. In another analogy, he defends the same point by noting that the weight of a ball may act perpendicularly even if it rests on top of a jumbled collection of balls in a vase (AT XI 100–1, G 64–65).

Descartes’ mechanistic approach to optics was crucially extended by his derivations of the two central laws of geometrical optics. In his *Dioptrics*, Descartes proposes to derive the law of reflection by attending to the behavior of a tennis ball rebounding at an angle off of a hard surface. In reference to Figure 19, he postulates that “a ball propelled by a tennis racquet from A to B meets at some point B the surface of the ground CBE, which stops its further passage and causes it to be deflected” (AT VI 93, CSM I 156).

In order to determine the angle of the ball’s reflection, Descartes suggests that “we can easily imagine that the determination of the ball to move from A toward B is composed of two others, one making it descend from line AF towards line CE and the other making it at the same time go from the left AC towards the right FE” (AT VI 95, CSM I 157–58). Arguing that the ray’s “encounter with the ground can prevent only one of these two determinations, leaving the other quite unaffected,” Descartes maintains that the horizontal determination of the tennis ball from A to H will remain constant in spite of the ball’s being reflected and thus will be equal to the horizontal determination from H to F (AT VI 95, CSM I 158). Assuming further that the total speed of the ball is unaffected by reflection, Descartes is able to deduce

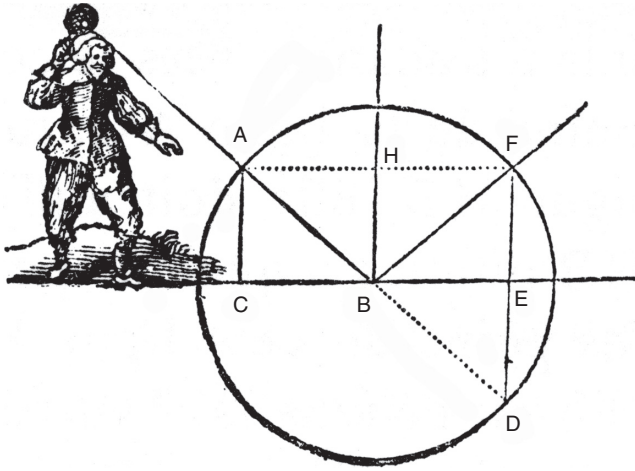


Figure 19. Descartes' tennis ball analogy for reflection (*Dioptrics*, 1637).

that the tennis ball must pass through the point F, and that the angle of incidence ABC must be equal to the angle of reflection FBE, in agreement with the accepted law of reflection known since at least the time of the ancient Greeks.

In the *Dioptrics*, Descartes next derives the law of refraction in a similar fashion by replacing the hard ground of the previous demonstration with “a linen sheet ... which is so thin and finely woven that the ball has enough force to puncture it and pass right through, losing only some of its speed ... in doing so” as depicted in Figure 20 (AT VI 97, CSM I 158). Descartes further assumes that the total speed of the ball is determined by the resistance of the mediums through which it travels, and that its horizontal speed must remain constant since, in passing from the first medium to the second, “it loses none of its former determination to advance to the right” (AT VI 98, CSM I 158).

Letting HF be twice the length of AH and supposing that the ball travels twice as fast in the incident medium as in the refractive medium, Descartes argues that the ball must reach a point on the circumference of the circle at the same time that it reaches some point on the line FE (since by the first assumption, if the ball travels from A to B in one unit of time, it will travel from B to the circumference in two units of time, and by the second assumption, if the ball travels from A to H in one unit of time, it will travel from H to F in two units of time). Given these assumptions, Descartes concludes that it must be the case that the ball goes “towards I, as this is the only point below the sheet CBE where the circle AFD and the straight line FE intersect,” and therefore that the ratio of the sine of the angle of incidence (BC) to the sine of the angle of refraction (BE) is a constant determined by the ratio of the resistance of the incident medium to the resistance of the refractive medium (AT

Holland – a charge first made publicly by Isaac Vossius in 1662, but intimated earlier by both **Christiaan Huygens** and **Leibniz**. Although suspicions of plagiarism have persisted to the present day (and, indeed, the law of refraction is now known alternatively as Snell’s Law, Descartes’ Law, and the Descartes-Snell law) there appears to be no decisive evidence supporting the charge, and leading scholars have concluded that Descartes most likely arrived at his results independently of Snell’s work (Sabra 1967, 102–3; Schuster 2000, 303n. 3).

Although Descartes is perhaps most famous today, with respect to the history of optics, for his role in the discovery of the law of refraction, his derivations of the laws of optics are but one element of an even more ambitious project. Having discussed the nature and laws of light in the first two discourses of the *Dioptrics*, Descartes devotes its next four discourses to the topic of vision. Following closely Kepler’s “two-cone” theory of the formation of retinal images, Descartes begins by explaining how “the objects we look at do imprint very perfect images on the back of our eyes” (AT VI 114, O 91). In reference to Figure 21, he holds that rays of light emitted from the visible bodies V, X, Y fan out in all directions and are subsequently refracted by “the three surfaces of [the eye] BCD, 123, and 456 ... in the way that is required for them to reconverge at a single point,” as, for example, T, S, or R (AT VI 117, O 93).

Having clarified how “the images of objects form thus on the back of the eye,” Descartes proceeds to explain how “they also pass beyond to the brain,” suggesting that rays striking the back of the eye stimulate individual fibers of the optic nerve so that a picture “which is quite similar to the objects V, X, Y is formed once more on the interior surface of the brain” and is in turn transported to “a certain small gland ... which is the seat of the **common sense**” (AT VI 129, O 100) (see **pineal gland**). Although the physiological side of Descartes’ account of vision might seem to imply that the process of vision is exhausted by a point-by-point transmission of images, he explicitly rejects just such a view, emphasizing that “we must not hold that it is by means of this resemblance that the picture causes us to perceive the objects, as if there were yet other eyes in our brain with which we could apprehend it” (AT VI 130, O 101). Descartes’ positive view is that rays of light mechanically stimulate our eyes, that those stimulations are then mechanically passed to the interiors of our brains, but that once there they “act immediately on our mind in as much as it is united to our body” and give rise, under the right circumstances, to our familiar perceptual experiences (AT VI 130, O 101). As a blow to the eye that results in the perception of a colored flashes attests, the cause of a visual perception and the visual perception itself need not resemble one another in any significant way (AT VI 131, O 101–2).

In the *Dioptrics*, Descartes’ treatment of vision sets the stage for an extended discussion of its natural limitations and the means available for improving it. It is in this context that Descartes introduces his theoretical **explanation** of the telescope

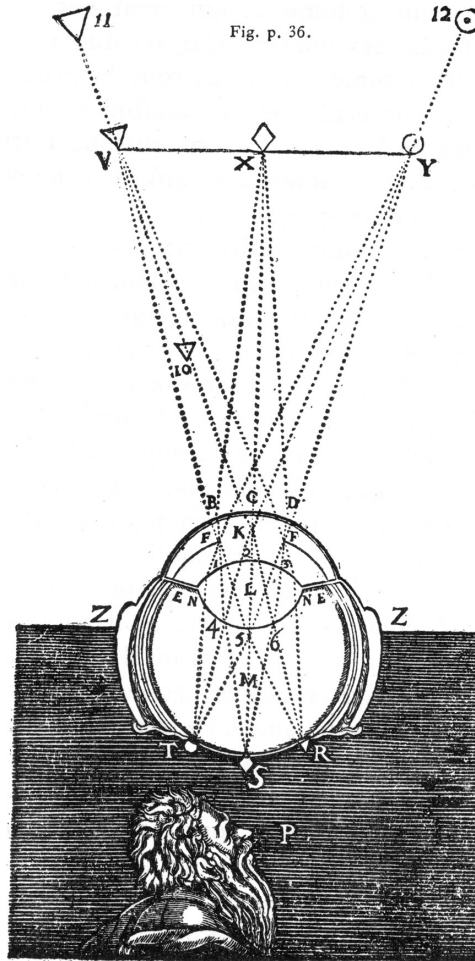


Figure 21. Retinal images and the convergence of light (*Dioptrics*, 1637).

by means of a three-part thought **experiment** (Ribe 1997, 54). First, Descartes proposes that “inasmuch as the first of the three liquids that fill the eye causes nearly the same refraction as common water,” we may imagine an eye being extended by placing “right against it a tube full of water, such as EF,” capped by a lens of roughly the same shape as the outer surface of the eye itself, as in Figure 22. Second, Descartes notes that “inasmuch as it would be very inconvenient to join water against the eye in the manner that I have just explained,” the same effect might be obtained by placing a solid tube filled with a single lens or lenses or “other transparent bodies” just in front of the eye as in Figure 23.

Descartes next notes, however, that since “there would again be some inconvenience in finding lenses or other such bodies sufficiently thick to fill the entire tube

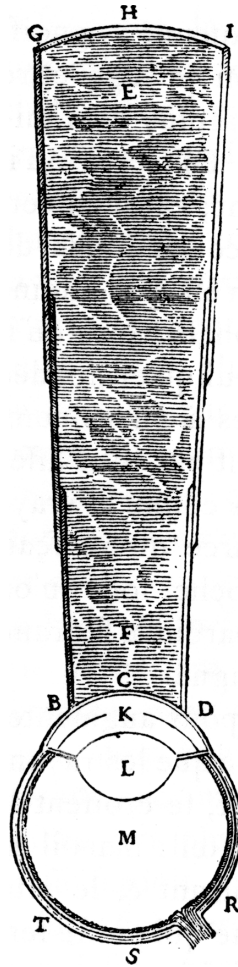
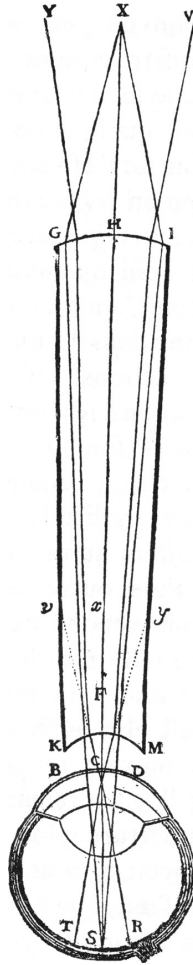


Figure 22. Tube filled with water (*Dioptrics*, 1637).

HF, and sufficiently clear and transparent so that they would not impede the passage of light ... we will be able to leave the whole inside of this tube empty, and merely place, at its two ends, two lenses which have the same effect" (AT VI 159, O 122). He proudly concludes that "on this alone is founded the entire invention of these telescopes composed of two lenses placed in the two ends of a tube, which gave me occasion to write this *Treatise*" (AT VI 159, O 122). Descartes goes on to develop this initial explanatory sketch, applying results from his *Geometry* to explain the refractive properties of lenses used individually and in combination (discourse 8), provide guidance on the construction of magnifying glasses, telescopes, and microscopes (discourse 9), and even outlining procedures for grinding hyperbolic lenses (discourse 10) (Ribe 1997, 56).

Figure 23. Solid tube (*Dioptrics*, 1637).

If Descartes' treatment of the telescope serves as the crown jewel of his *Dioptrics*, his brilliant analysis of the **rainbow** serves the same function in his *Meteors*. In the beginning of the eighth discourse of that essay, he announces, "The rainbow is such a remarkable phenomenon of nature, and its cause has been so meticulously sought after by inquiring minds throughout the ages, that I could not choose a more appropriate subject for demonstrating how ... we can arrive at knowledge not possessed at all by those whose writings are available to us" (AT VI 325, O 332). Making experimental use of "a perfectly round and transparent large flask [filled] with water" as a convenient substitute for actual raindrops, and making reference to Figure 24, Descartes draws three especially noteworthy conclusions.

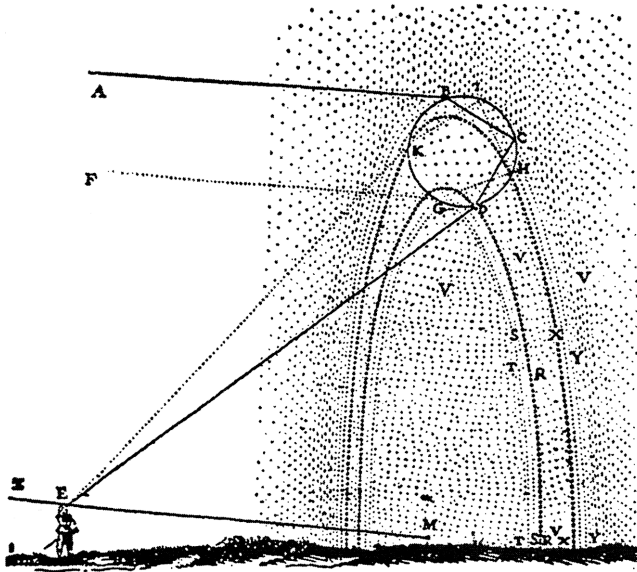


Figure 24. The geometry of the rainbow (*Meteors*, 1637).

First, tracing the rays of light from “the section of the sky marked AFZ,” Descartes observes that the height of the primary rainbow, as measured by the angle DEM, is approximately 42 degrees, and the height of the secondary rainbow, as measured by the angle KEM, is approximately 52 degrees (AT VI 326–27, O 332–33). Second, Descartes concludes that “the primary rainbow is caused by the rays which reach the eye after two refractions and one reflection [as, for example, at B, C, and D], and the secondary by the other rays which reach it only after two refractions and two reflections,” as, for example, at G, H, I, and K (AT VI 329, O 334). Third, and most significantly with respect to the development of the history of optics, Descartes shows through a series of systematic calculations that the once-reflected and twice-refracted rays should cluster around a maximal observational angle of approximately 42 degrees (roughly the observed angle of the primary rainbow), while twice-reflected and twice-refracted rays should cluster around a minimal observational angle of 52 degrees (roughly the observed angle of the secondary rainbow) (AT VI 336–40, O 339–42). This important result allows Descartes to offer novel explanations of an important range of phenomena that had long puzzled investigators of the rainbow such as, for example, why primary rainbows are most brightly and sharply defined at their upper extremes, while secondary rainbows are most brightly and sharply defined at their lower extremes (Boyer 1987, 211–15; Buchwald 2007).

Descartes’ influence on the subsequent history of optics is difficult to overestimate. Many of his published results – including the law of refraction, his descriptions of anaclastic curves, and his explanation of the rainbow – represent clear advancements and served as solid foundations for subsequent natural philosophers and

scientists to build upon. Such was the nature of Descartes' genius, however, that he managed to make equally great contributions to the history of optics even where he was taken to have gone most wrong. Dissatisfied with Descartes' derivations of the law of refraction, Fermat showed how essentially the same results could be obtained from an easiest path principle. Opposing Descartes' view that light is merely a tendency to motion and is propagated instantaneously, Christiaan Huygens developed his wave theory of light and used it to successfully explain a range of recalcitrant phenomena, including, most famously, the refractive properties of Iceland Spar. Likewise, **Newton's** famous experiments with prisms and his novel theory of colors were instigated by his acquaintance with Descartes' published views. Few in the history of science, it is safe to say, have been so successful, in both success and failure, as Descartes in his work on optics.

See also *Analogy*; *Discourse on Method*; *Dioptrics*; *Experiment*; *Explanation*; *Fermat, Pierre de*; *Force and Determination*; *Galilei, Galileo*; *Hydrostatics*; *Kepler, Johannes*; *Law of Nature*; *Light*; *Method*; *Motion*; *Mydorge, Claude*; *Newton, Isaac*; *Perception*; *Physics*; *Rainbow*; *The World*

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ORATORIAN

The name refers to any member of the Society of the Oratory of Jesus, also called the French Congregation of the Oratory, founded by **Pierre de Bérulle** (1579–1629) in 1611 and officially instituted by Pope Paul V in 1613. He modeled it in part after the Oratory of Saint Phillip Neri (members of which are also called Oratorians) and adopted some of its practices, but aside from this there is no further connection between the two. Bérulle was motivated to form the congregation by a desire to reform the priesthood in France. His aim was to establish a society of theologically educated and morally upstanding priests capable of instructing the laity on the truths of the Catholic faith, in his mind a much needed response to the Protestant threat. With regard to theology, Bérulle was influenced by Neoplatonism in general and **Saint Augustine** in particular, and the society would grow to include many Augustinian theologians. As for philosophy, though it would be too strong to call Bérulle a Cartesian – he was more concerned with matters religious and political – he was favorably disposed to the work of Descartes. Over the course of the seventeenth century, however, the congregation would include philosophers properly considered Cartesian, such as **Bernard Lamy** (1640–1715) and **Nicolas-Joseph Poisson** (1637–1710), as well as those whose thought is heavily indebted to Descartes, such as **Nicolas Malebranche** (1638–1715). On the other hand, **Jean-Baptiste de la Grange**, a fierce opponent of **Cartesianism**, was also an Oratorian, as was Jean-Baptiste Duhamel (1624–1706), who sought to blend the best elements of ancient philosophy and Cartesianism. While its primary mission was the spiritual formation of priests, the society also committed itself to educating the young, running many colleges in France, including those at Saumur, Mans, Vendôme, Juilly, and Angers. Though Bérulle himself held the **Jesuit** order in high regard and counted several Jesuits among his friends, friction quickly developed between the Oratory and the Society of Jesus, in part because the latter viewed the former as a rival regarding education of the youth. In 1792 the chaos caused by the French Revolution led to the disbanding of the congregation, though the society was re-formed sixty years later, in 1852, by Joseph Gratry. Today there are approximately fifty French Oratorians.

Bérulle and Descartes likely knew each other in Paris when Descartes resided there in the late 1620s. **Baillet** reports that it was Bérulle who, in a private meeting between the two in 1628, told Descartes that it was his obligation to **God** to put his **knowledge** in writing for the benefit of others, thereby inspiring Descartes' move to Holland to write in peace, but there is reason to doubt such a meeting ever took place. Aside from this, the French Oratory is linked to Cartesianism in four noteworthy ways. The first is Descartes' association with the Oratorian **Guillaume Gibieuf** (ca. 1583–1650), whom he met in Paris in the 1620s and with whom he corresponded,

mostly indirectly though **Marin Mersenne**, after his relocation to Holland. Second, it was an Oratorian, **Nicolas-Joseph Poisson**, who translated into French (with introduction and commentary) Descartes' *Compendium of Music* in 1668. Third, there were Cartesian professors teaching at some of the more than a dozen Oratorian colleges established during the seventeenth century. Of special note is the affair at Angers. Despite orders from the king and the congregation against the teachings of Descartes, four Oratorian professors at Angers – the aforementioned Lamy, Cyprien de Villegroze, Vincent Pélaud, and a Father Fromentier – were censured in 1675, with Lamy and Fromentier being explicitly charged with (among other things) teaching ideas deemed Cartesian. The fourth connection with Cartesianism is Malebranche himself. While he was strongly influenced by Descartes, Malebranche was an original thinker and one of the most important and influential philosophers of the last decades of the seventeenth century.

See also Augustine, Aurelius; Bérulle, Pierre de; Cartesianism; Faith, Religious; Gibieuf, Guillaume; Lamy, Bernard; Malebranche, Nicolas; Mersenne, Marin; Poisson, Nicolas-Joseph

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FRED ABLONDI

PASCAL, BLAISE (1623–1662)

Blaise was the son of the mathematician Étienne Pascal (1588–1651) and had no other teacher. Étienne's greatest pedagogical challenge, however, was keeping up with his precocious son. By the age of twelve, Blaise had already discovered the elements of **geometry** with a vocabulary and by a **method** of his own devising. This achievement led his father to introduce the boy to **Marin Mersenne's** scientific academy. By the age of sixteen, Blaise had extended some work on conic sections done by the mathematician **Girard Desargues** in a way the mathematicians of Mersenne's academy thought brilliant.

Some people say Pascal supplies the intuitive mysticism they find lacking in the scientific rationalism of Descartes. Together the two great philosophers are supposed to express the full range of French (or even of modern) thought. There is some truth in this commonplace, but Pascal was as indebted to Descartes as he was wary of him, and their complicated relationship deserves the scholarly attention it continues to receive.

It was his work on conic sections that first brought Pascal unflattering attention from Descartes. In a Grinch-like letter written to Mersenne on Christmas Day of 1639, Descartes pettily observes that he knows of problems regarding conics that “a child of sixteen would have trouble solving” (AT II 628). Descartes' attitude to Pascal was always condescending, and Pascal learned to reciprocate with disdain. “Descartes: useless and uncertain,” is one of the summary notes from Pascal's fragmentary, posthumous religious classic *The Pensées* (1963, 615, no. 887). Much of Descartes' animosity toward Blaise can be explained by Étienne Pascal's association with **Roberval**, who, along with **Beaugrand** and **Fermat**, had criticized Descartes' **optics**.

In September 1647, Descartes made a friendly call on the Pascals, mainly out of interest in seeing a working model of the reckoning **machine** Blaise had developed, which could perform all four arithmetic operations (though it multiplied and divided only with difficulty). Descartes admired it, but the conversation later turned to another sore point, namely, Pascal's attempt to replicate Torricelli's **experiments** with barometers. Pascal claimed that when a tube filled with mercury is inverted, the mercury dropping from the closed end of the tube leaves a **vacuum** behind. Descartes held instead that the space filled up with what he called “**subtle matter**.” Pascal did not change his mind (AT V 72). So later, with spiteful ambiguity, Descartes told **Constantijn Huygens** that Pascal seemed to have the vacuum “too much in his head” (AT V 653). Descartes would also claim that it was he who had given Pascal the idea for conducting the barometric experiments at different altitudes that contributed to the latter's scientific fame (AT V 99).

In 1655 Pascal met **Antoine Arnauld**, the famous Cartesian and most vocal supporter of **Jansenism**. Pascal had converted to Jansenism in 1646 and subsequently

defended it, while attacking the **Jesuits**, in *Lettres provinciales* (1656–57). In the last years of his short life, Pascal composed notes toward his apology for Christianity, the *Pensées*, in which he reproaches Descartes for hyperrationalism and scientism. In their place Pascal puts probabilism, empiricism, and what he famously calls “reasons of the heart.”

See also Arnauld, Antoine; Jansenism; Subtle Matter; Vacuum

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GRAEME HUNTER

PASSION

Descartes employs the term “passion” in three ways. In **physics**, a passion is anything that “takes place or occurs” as the result of “that which makes it happen” (AT XI 328, CSM I 328). In physiology, a passion is a corporeal impulse of the animal **body** (AT V 278, CSMK 366). In psychophysics, “passions of the soul” are **modes** of the soul that “depend absolutely” on actions of the body (AT XI 359, CSM I 343). The following entry considers only this last category of passions, focusing on their relationship to actions in the body, their **definition**, their functions, and their relationship to **virtue**.

I. ACTION AND PASSION: *UNAM ET EADEM REM*

As Descartes writes to **Hyperaspistes**, it is “contradictory that there should be a passivity without an activity for even a single moment” (AT III 428, CSMK 193).

Indeed, actions and passions are “one and the same thing” (*unam et eadem rem*), called an “action” when referred to the agent and a “passion” when referred to the patient (AT III 428, CSMK 192–93). This identification between actions and passions is repeated at the beginning of the *Passions of the Soul*. Even though the agent and patient are often quite different, action and passion are always one and the same thing (*une meme chose*) (*Passions*, I.2). In the letter to Hyperaspistes, Descartes allows that a thing (e.g., a top) may act on itself, but in the case of passions of the soul, the agent is one thing (the body), the patient another (the **mind**).

Paul Hoffman (1990, 317) points to a problem here: if the agent and patient are really distinct, then, given Descartes’ theory of **distinctions** (AT VIIIA 28–30, CSM I 213–15), actions and passions should also be really distinct. But given the identification of actions and passions (*Passions*, I.1), they cannot be. Nor can they be modally distinct either, since that presupposes separability as well. This leaves only the distinction of reason, but the question then is how a mode of an immaterial **substance** could be identical with a mode of **extension**? What sort of *nature* could a mode of **mind** share with a mode of body?

There is no easy way out of these conundrums. Some have been inclined to think that Descartes is simply adopting an Aristotelian **idea** without fully understanding its implications (see *Metaphysics* IX, 1048b, 18–25; Des Chene 1996, 257–72). Hoffman (1990, 313–21) defends the view that action and passion constitute a single mode of two substances – a “straddling mode” – citing Descartes’ identification of the surfaces of distinct bodies in contact and of the images in the corporeal **imagination** with ideas in the soul as evidence of a general reliance on straddling modes. Brown and Normore (2003) and Brown (2006, ch.5) defend the view that Descartes is committed to metaphysically interdependent but numerically distinct modes of distinct substances (cf. Kambouchner 1995, 94–95). They advocate avoiding the conclusion that there could be one mode belonging to two distinct natures, **thought** and extension. Whichever interpretation is correct, it should be noted that the identification of actions and passions is not incompatible with **dualism**. Since no substance is dependent upon any particular mode, the fact that a substance has modes that depend upon another substance does not render it dependent on that other substance for its **existence**.

2. DEFINITION OF THE PASSIONS

Descartes’ “first and general definition” is that the passions are all the thoughts “excited in the soul without the concurrence of her will ... solely through the impressions in the brain, because that which is not an action is a passion” (AT IV 310, CSMK 270). Passions are “those **perceptions, sensations** or emotions of the soul which we refer particularly to it, and which are caused, maintained and strengthened

by some movement of the spirits” (AT XI 349, CSM I 338–39). Although Descartes thinks that each passion depends upon a dedicated movement of the nerves and **animal spirits** as its **cause**, passions are differentiated from one another by the thoughts they are associated with. For example, fear is a movement of the spirits associated with a thought about something dangerous, anger with some injustice, grief with loss. There is continuity here with the Scholastic tradition in which passions were typically defined as **motions** of the sensitive appetite based on sensitive apprehensions of good and evil (see *Aquinas, Summa Theologica* I–II, q.22, a.1–3; Kambouchner 1995, ch.1; Brown 2006, ch.2). Descartes thinks of the particular associations individuals forge as largely habitual and that mastery of the passions consists in realigning the connections between sensory inputs and thoughts (see **habit**) (Shapiro 2003; Alanen 2003a, 199).

The passions of the soul are differentiated from other sensations by being “referred to the soul itself.” Descartes explains that this is because we cannot refer them to any “proximate cause” (AT XI 347–48, CSM I 337–38). Since we do not know the proximate cause of any sensation, this is mysterious. Nor should we think that just because we refer passions to the soul, they are volitions. Passions originate in the body; volitions, in the soul (AT XI 342, CSM I 335; AT XI 350, CSM I 359). We know the difference between passions and volitions because we know that the will cannot directly alter a passion (AT XI 359–60, CSM I 343). But why then do we not refer our passions to the external objects we associate with them?

There is a tension here. On the one hand, Descartes is keen to avoid the Stoic view that passions are false **judgments** and thus subject to direct rational control. On the other hand, he does not clearly distinguish passions and judgments. The Sixth Replies states that every sensation involves a judgment at the “third grade of sensory response” (AT VII 436–37, CSM II 294–95; AT VII 86, CSM II 59). One solution is to suppose that Descartes is thinking of passions as “spontaneous” or non-volitional judgments, experienced as *originating* in the soul as if they were volitions or moral judgments (Alanen 2003a, 185–86; 2003b). This reading is difficult to reconcile with Descartes’ general reliance on the experienced *passivity* of our sensory/emotional ideas to establish that bodies exist (AT VII 79–80, CSM II 55). It is also difficult to see how the will could fail to be involved in judgment, although in what capacity the will is involved in these habitual judgments we inherit from childhood is a good question.

Another way to understand what “referring a passion” means is as a kind of “*experiencing as*” on the model of “*seeing as*,” which is semantically complex but logically prior to judgment (Brown 2006, ch. 4). Sensations we refer to external things or to our bodies are experienced as modifications of them – I see the torch *as lit* and feel the foot *as painful*. But the passions are always experienced as ways the soul is modified – as, say, afraid or grief-stricken. Of course, the passions also typically represent the utility or disutility of external objects. My soul is afraid, not the spider, although

it is afraid of the spider because of past unpleasant encounters with spiders (cf. AT XI 356, CSM I 342).

3. FUNCTION OF THE PASSIONS

In articulating the function of the passions, Descartes emphasizes their role in preserving the unity of mind and body (see **human being**). Their function “consists solely in this, that they dispose our soul to want the things which nature deems useful for us and to persist in this volition; and the same agitation of the spirits which normally causes the passions also disposes the body to make movements which help us to attain these things” (AT XI 372, CSM I 349). The passions best serve their proper function only in the context of the whole rational agent, who is able to “use experience and **reason** to distinguish good from evil and know their true value” (AT XI 431, CSM I 377).

This last observation helps alleviate one difficulty that arises from Descartes’ bifurcation of **animal** passions and passions of the soul – namely, why it is functionally necessary for human beings to have both. Each passion involves a movement of the animal spirits sufficient to turn our bodies toward or away from the objects we need to seek or avoid. Descartes notes, however, that animals are easily deceived by lures and subject themselves to greater evils to avoid small ones. Our ability to use reason informed by passion gives us an adaptive advantage (*ibid.*).

But given our impotence to directly control our passions, how is it possible for us to gain dominion over them? In response to this question, Descartes offers several remedies for unruly passions: (1) medicinal (AT IV 220, CSMK 250), (2) psychotherapeutic (AT XI 363–67, CSM I 345–48; AT IV 220, CSMK 250), and (3) rational or moral – we must use reason to formulate “firm and determinate judgments” in order to know the true worth of objects, develop the right kind of self-esteem, and understand our place in the Providential order (AT XI 363, CSM I 345; AT XI 367–68, CSM I 347; AT XI 436–38, CSM I 379–80; AT XI 446–47, CSM I 384). One must use a variety of techniques lest the soul be carried away by passions that often conflict, leaving the soul “in the most deplorable state” (AT XI 367, CSM I 347).

4. PASSION AND VIRTUE

The passions are intimately connected with our moral life: “It is on the passions alone that all the good and evil of this life depends” (AT XI 488, CSM I 404; Blom 1978). The passions introduce us to value and are the source of our “sweetest pleasures” as embodied beings. Even the evils we inevitably suffer can be a source of pleasant internal emotions such as intellectual joy or self-satisfaction, the most

intriguing example of which is that of the husband who feels a “secret inner joy” aroused by sadness at the loss of his wife, a joy so great that he would be sorry to see her return (AT XI 441, CSM I 381). Lest this suggest that our **happiness** rests entirely on passions that depend upon the vicissitudes of fortune and temperament of our bodies, Descartes is quick to assert that happiness depends on the exercise of virtue or “doing what we judge to be best” (AT XI 441–42, CSM I 381–82).

None of this means that the exercise of virtue is an activity of the soul alone. Virtue is bound with a passion – generosity – the habitual disposition to use the will well (AT XI 446, CSM I 384; AT XI 453–54, CSM I 387–88). Generosity originates from thoughts in the soul strengthened by some movement of the spirits. Cartesian generosity is not like our modern concept of generosity (public spiritedness), although it is intimately related to it. It is rather *legitimate self-esteem* that consists, first, in knowing that nothing truly belongs to us but the freedom to dispose our volitions and, second, in feeling a firm and constant resolution to use the will well, that is, in accordance with reason (AT XI 445–46, CSM I 384). Once we recognize that our **free will** has the highest value for us and is insulated from fortune, we are prevented from having contempt for others whom we see as also possessing free will, whether they use it well or badly. Thus we are inclined to be generous in the modern sense toward them (AT XI 446–48, CSM I 384–85). The public obligations of the Cartesian sage are not, however, mere byproducts of generosity but follow essentially from the very foundations of virtue, a correct understanding of the will and commitment to use it well (cf. AT VI 61, CSM I 142). Less clear is whether generosity and virtue are the same habit or distinct but related (Naaman-Zauderer 2010, 198–204; cf. Brown 2006, 188).

By connecting virtue with a passion, Descartes distances himself from Stoic ethics, telling us he is not one of those “cruel philosophers” who wants his sage to be insensible (AT IV 201–2). Nor does he think that virtue depends on **knowledge**, on which the Stoics and Aristotelians agree, and which for the Stoics demands that we withhold assent from all practical judgments that are not clear and distinct (Levi 1964, 287; Knuuttila 2004, ch.1). The connection between virtue and self-esteem was, however, a well-established feature of traditional virtue ethics, built around the notion of *magnanimitas* (Latin) or *megalopsychia* (Greek) – “great souledness.” The *megalopsychē* esteems her own virtue, neither too much (for this is vanity) nor too little (for this is debasing humility) (AT XI 448–52, CSM I 385–87). In Descartes’ milieu, *générosité* connoted nobility of birth or, in his more egalitarian usage, nobility of mind (AT XI 453, CSM I 387–88; Shapiro 1999). Descartes initially invokes the traditional concept of magnanimity (AT XI 374, CSM I 350) but later switches to generosity (AT XI 453–54, CSM I 387–88), suggesting a new emphasis on the virtuous will and dispensing with the unity of virtue and knowledge central to Aristotelian and Stoic ethics. Resolution becomes as an essential element of virtue (Brown 2006, ch.8). Prudence dictates that we act; prolonged irresolution

is a vice (AT XI 459, CSM I 390). The Cartesian sage is wise precisely because she judges and acts optimally under conditions of uncertainty. Descartes joins the Stoics (against the Aristotelians and Elisabeth's melancholic doubts), however, in disallowing that either virtue or happiness depends upon fortune. The "principal utility of morality" is the control of desires for things that do not depend upon us (AT XI 436, CSM I 379).

A notable gap in Descartes' account of virtue is the absence of an independent conception of the good, aside from the circular idea that the good consists in the good use of the will (Normore unpublished manuscript; Levi 1964, 287–306; cf. Kambouchner 2008, ch.5). But it does not follow, on Descartes' view, that any action willed resolutely will be virtuous. Since most of our moral errors stem from being misled by our passions, with control over the passions the judgments we assent to are more likely to be true. Because the *généreux* esteem nothing more than their will and what depends only upon themselves, they are less prone to jealousy, envy, anger, hatred, fear, and intemperate desire (AT XI 447–48, CSM I 385; AT XI 481, CSM I 400–1). The ingenuity in Descartes' identification of virtue with this crowning passion rests here. Passions do not occur in isolation but typically form series. Esteem gives rise to love, hope, desire, and action. By controlling self-esteem, one minimizes esteem for objects outside one's control and all the passions and actions that follow from such esteem. This is not to suggest that the *généreux* are unmoved by external objects – they are especially moved by compassion (AT XI 470, CSM I 395) – but the perspective afforded through reflection on the value of the will allows them greater freedom to exercise reason and constraint than they would otherwise have.

See also *Anatomy and Physiology, Animal Spirits, Free Will, Happiness, Human Being, Judgment, Mind, Passions of the Soul, Reason, Sensation, Virtue*

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DEBORAH BROWN

PASSIONS OF THE SOUL

Les passions de l'âme, Descartes' last major work, was published in November 1649, shortly before his death. This work grew out of his **correspondence** with **Princess Elisabeth of Bohemia** during the 1640s. The correspondence opens with Elisabeth urging Descartes to explain "how the soul of a **human being** (in being only a thinking **substance**) can determine the bodily spirits, in order to bring about voluntary actions" (May 6, 1643; AT III 661). Elisabeth's genuine theoretical interest in the mind-body interaction was accompanied by a more practical concern: crowning Descartes "the best doctor for my soul," she expected him to cure her **body** by supplying her with remedies for the afflictions of her soul (May 6, 1643; AT III 662; May 24, 1645; AT IV 208). This twofold initiative prompted Descartes to develop his theory of the **passions** and related ethics in a new, systematic fashion.

The *Passions of the Soul* opens with Descartes conveying unease with the ancients' teachings on the passions. He is therefore "obliged to write just as if [he was] considering a topic that no one had dealt with before." In a prefatory letter to the treatise, he proclaims his intention "to explain the passions only as a natural philosopher [*physicien*], and not as a rhetorician or even as a moral philosopher" (AT XI 326, CSM I 327). This claim may seem puzzling given the weight he assigns in this work to the ethical ramifications of the analysis of the passions. In underestimating his significant ethical concerns, Descartes may have intended to stress the novelty of his own mechanistic approach to the topic. On his approach, the passions

are mental phenomena originating in bodily changes, which are transmitted to the **pineal gland** through movements of the **animal spirits** without the concurrence of the will. Departing from the Aristotelian Scholastic accounts of the passions as phenomena belonging to the appetitive faculty, Descartes seeks to provide a new mechanistic account of the passions and their physiological origin, in accordance with his new **physics** and the metaphysical **dualism** of body and **mind**.

The *Passions of the Soul* comprises three parts. Part I (arts. 1–50), entitled “The Passions in General and incidentally the whole nature of man,” includes Descartes’ **definition** of the passions as “those **perceptions, sensations** or emotions of the soul which we refer particularly to it, and which are caused, maintained and strengthened by some movement of the spirits” (I.27; AT XI 349, CSM I 338–39). As body-dependent mental states, the passions are contrasted with volitions or actions of the soul, which are the **thoughts** caused by the mind alone and dependent on the will. While all thoughts passively excited in the soul by cerebral movements deserve to be called passions in the broad sense, Descartes confines himself in this treatise to discussing only those perceptions that we refer to the soul while ignorant of their proximate **cause**. Unlike sense perceptions (such as **light**, heat, or sound) that we refer to the external objects causing them (I.23), and unlike appetites (such as hunger, thirst, or pain) that we attribute to our body (I.24), the passions in the strict sense are those perceptions (such as the feelings of joy, anger, fear, and the like) “whose effects we feel as being in the soul itself, and for which we do not normally know any proximate cause to which we can refer them.” The latter are aroused in us “sometimes by the objects which stimulate our nerves and sometimes also by other causes” (I.25; AT XI 347, CSM I 337).

Since each passion is passively aroused in the soul by specific movements in the pineal gland, Descartes delves into the physiological mechanism that excites different passions in the soul. Yet, although different passions arise from different movements of the gland, the principal effect of all the human passions is the same: “They move and dispose the soul to want the things for which they prepare the body. Thus the feeling of fear moves the soul to want to flee, that of courage to want to fight, and similarly with the others” (I.40; AT XI 359, CSM I 343). The passions are therefore crucial for the preservation of the mind-body union. They dispose the soul to want the things that may benefit us and avoid those that may harm us. Descartes proceeds to consider the various functions of the soul, the mind-body interaction, and the power of the soul over its passions. His therapeutic devices include the breaking of well-established patterns of emotional response and the creation of new associations between recurrent stimuli and passions we find preferable (I.50; AT XI 368–69, CSM I 348; cf. I.136) (see **habit**).

Part II (arts. 51–148) is entitled “The Number and Order of the Passions and explanation of the six primitive passions.” It enumerates six simple or primitive passions – wonder, love, hatred, joy, sadness, and desire – of which all other

passions are either species or combinations (II.69). Descartes places significant emphasis on desire (*désir*), the primitive passion closest to action, which prompts us to act by strengthening the effect of the passions that give rise to it (II.144). Since the passions govern our behavior through the desire they produce, “it is this desire which we should take particular care to control; and here lies the chief utility of morality” (II.143–44; AT XI 436, CSM I 379). Regulating the passions consists in channeling our desires to things dependent on our **free will**, of which the highest and most valuable is the pursuit of **virtue**, the highest good, which Descartes reduces to the good use of the will (II.144). This discussion paves the way for Descartes’ account of **generosity** in part III, the culmination of the entire work.

Part III (III.149–212), entitled “Specific Passions,” is an analysis of particular passions of which generosity (*générosité*) is the most significant. Cartesian generosity is both a passion and a virtue and, indeed, “the key to all the other virtues and a general remedy for every disorder of the passions” (III.161; AT XI 454, CSM I 388). Having attained a habitual desire for virtue, the generous agent reaches the highest moral level accompanied by tranquility or enduring **happiness**. The treatise concludes with Descartes stressing the valuable merit of one’s mastery over the passions and the affective ramifications of this end: “But the chief use of wisdom lies in its teaching us to be masters of our passions and to control them with such skill that the evils which they cause are quite bearable, and even become a source of joy” (III.212; AT XI 488, CSM I 404).

See also Animal Spirits; Body; Dualism; Elisabeth, Princess of Bohemia; Habit; Happiness; Human Being; Mind; Passion; Pineal Gland; Virtue

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NOA NAAMAN-ZAUDERER

PELAGIANISM

Pelagius, a British monk (ca. 360–420 C.E.), defended the view that even after Adam and Eve's original sin mankind retained the ability not to sin. We are born, Pelagius said, "without virtue as without vice, and before the activity of our personal will there is nothing in man but what **God** has stored in him" (Bettensen 1954, 75). This view was attacked by **Saint Augustine** and condemned as heretical in the Synod of Carthage (418 C.E.). A related view, which came to be known as "Semi-Pelagian," held that the beginning of saving faith lies in an unconditioned act of **free will** (see Pohle 1913).

Behind the Pelagian controversy lies a theological puzzle that may never be entirely solved. If divine grace is given independently of our will, as Saint Augustine and his followers down the centuries have held, it seems to lead to the doctrine that people are predestined by God to either salvation or damnation, before they have a chance to act or even to exercise their own will. On the other hand, if the Pelagians are correct, and salvation depends on, or at least begins with, a free act of the human will, it is unclear why the sacrificial death of Jesus Christ was necessary at all, since even without it people could in principle have pleased God by willing to do whatever was necessary for their salvation. Orthodox Catholicism has always been

committed *both* to free will *and* to the priority and necessity of grace, but the two halves of orthodox doctrine have never been reconciled so convincingly as to keep Pelagianism from resurfacing.

In the heated religious battles of the seventeenth century, Pelagianism became one of the “stock accusations” theological controversialists hurled at each other and at philosophers, particularly when they dared to expound novel ideas (Davies 2001, 136). Protestants condemned the entire Roman Catholic Church of their day as Pelagian, while both the Catholic and Protestant communities were also internally divided on the issue. Within the Roman Catholic faith, **Jansenists** and Dominicans attributed Pelagianism to the **Jesuits**, while Dutch Calvinists detected it among the Arminians.

Descartes’ novel doctrine of the infinity of the human will, which he develops in the Fourth Meditation, was occasionally rumored to be Pelagian. Since he argues that the will can be used properly to avoid error and admits the analogy between error and sin, some scholars have been surprised that the charge of Pelagianism was not leveled against him with greater force (see Davies 2001, 135ff., and **error, theodicies of**).

It did surface, however, on two different occasions in the 1640s. In a letter written in March 1642 to his friend **Marin Mersenne**, Descartes complains of unnamed persons who have called his proofs of the **existence** of God Pelagian. Descartes counters that one can prove God’s existence by natural reason without acquiring the kind of meritorious faith in God that assures us of eternal life. Saving faith comes only through grace and entails believing in Jesus Christ and other matters of revelation that cannot be proved by natural reason (see **faith, religious**).

Later in the same decade, in a letter to the curators of Leiden University (dated May 4, 1647), Descartes responds to the charge again. In this case, he names his accuser as Jacob Revius, the regent (or dean) of a theological college at Leiden University (Verbeek 1995, 30).

In 1646, in connection with his decanal duties, Revius had organized a series of disputations “intended to discuss extensively every aspect of Descartes’ philosophy” (Verbeek 1995, 31). In the course of these disputations, Revius had charged Descartes with being “more than Pelagian,” on the basis of a passage he found in the Fourth Meditation in which Descartes says that “he conceives the will ... in such a way that no other could be greater.” Revius argues uncharitably and implausibly that in saying “no other could be greater” Descartes means even God could not be greater. In his letter to the curators, Descartes makes clear the absurdity of the charge. He also emphasizes his aversion to theological disputes. “Not a word, or barely a word, of my writings,” he assures the curators of the university, “is related to religious controversies including Pelagianism” (AT V 23).

See also Augustine, Aurelius; Faith, Religious; Free Will; God

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PERCEPTION

Descartes used the term "perception" (Latin *perceptio*, French *perception*) in several related ways. In the most general sense, expressed in a formal **definition** in the *Principles of Philosophy*, "perception" is any operation of the **intellect** (as contrasted with the will), comprising **sensation** or sense perception (*sentire*), **imagination**, and pure intellect or pure understanding (AT VIIIA 17, CSM I 204). In this general sense, to perceive is to be aware of or to grasp **ideas** or mental contents and perhaps, by virtue of such contents, to cognize mind-independent objects and their properties. Descartes applies this notion of perception to a variety of mental contents, including obscure and confused sensations, clear and distinct ideas (see **clarity and distinctness**), images in imagination, and purely intellectual ideas of **extension**, **thought**, and **simple natures**, as well as to principles such as "what is done cannot be undone" (AT VII 145, CSM II 104) and to everyday propositions, such as that **wax** is present or men are in the square. The latter act of perception is complex, involving the sensory experiences of human-shaped figures and the **judgment** that they are men (AT VII 32, CSM II 21).

For discovering and establishing the principles of Descartes' **metaphysics**, the clear and distinct perceptions of the pure intellect are foundational. His *Meditations* can be read as preparing a reader hitherto immersed in sensory experience to enter a special kind of cognitive state: the perception of metaphysical **truths** concerning the **essences** of things (AT VII 9, 171–72, 178, 440–47; CSM II 8, 121, 126, 296–301). Building on the claim in the Second Meditation that he perceives the **existence** of a thing that thinks from the experience of **doubt** or other thoughts (the *cogito* reasoning), Descartes guides the reader to seek a purely intellectual apprehension of **God** in the Third and Fifth Meditations, an intellectual perception of **extension** and of geometrical essences in the Fifth and Sixth Meditations, and the clear and distinct perception of **mind** and **body** as distinct kinds of **substance** in the Sixth Meditation.

For these purposes, Descartes has the reader turn away from sense perception and imagination. He excludes sense perception as a first basis for metaphysics, ceding authority to the intellect in perceiving “the essential nature of bodies” (AT VII 83, CSM II 58). For other purposes, sense perception and imagination are useful and should be trusted. In particular, the senses should be trusted in everyday life, “to inform the mind of what is beneficial or harmful for the composite of which the mind is part” (AT VII 83, CSM II 57) – that is, for the composite of mind and body that forms the **human being**. Also, because things are experienced as having various colors and other sensory qualities, we are correct to infer that there is a corresponding difference in the things (AT VII 81, CSM II 56). The senses can be trusted, in some circumstances, to provide information about the **shapes**, sizes, positions, durations, and **motions** of things (AT VIIIA 33–35, CSM I 217–18). This information serves natural philosophy for establishing properties such as the size and shape of the sun (AT VII 80, CSM II 55) and for deciding empirically among competing hypotheses about the (micro-) compositions of things (AT VI 63–65, CSM I 143–44; AT IXB 20, CSM I 189). Henceforth, our focus is on sense perception.

An important aspect of Descartes’ philosophy concerns the relation between what were subsequently called (by **Robert Boyle** and **John Locke**) “primary” and “secondary” qualities (see **quality, sensible**). The primary qualities were those assigned to matter in a corpuscular **physics**, including size, shape, position, and motion. The secondary qualities, including colors, sounds, tastes, odors, and tactual qualities such as hot and cold, wet and dry, were constituted from primary qualities in things and served to cause sensations or sensory ideas of those qualities in human perceivers. Descartes formulated an early version of this distinction, in opposition to Aristotelian “real qualities” (see **quality, real**). He offered specific accounts of the perception of size, shape, position, and motion, on the one hand, and of colors, sounds, tastes, and so on, on the other. Questions arise concerning whether sensory ideas of color and the like are representations or are bare sensations that do not represent properties of bodies. Another question concerns whether Descartes strictly distinguished “sensation” from “perception,” which he did not consistently do terminologically (see **representation** and **sensation**).

Descartes examined these topics in both his metaphysics (the *Meditations* and *Principles*, parts I and II) and natural philosophy, especially the *Dioptrics* and *Treatise on Man*. The *Dioptrics* covers the general operation of the senses and then focuses on visual qualities. It teaches, “All the qualities that we apprehend in the objects of sight can be reduced to six principal ones, **light**, color, location, distance, size, and shape” (AT VI 130, O 101). Descartes treated light itself as motion in a material medium. The sensations of light and color depend on motions in the nerves caused by motions in the medium (see **optics** and **quality, sensible**).

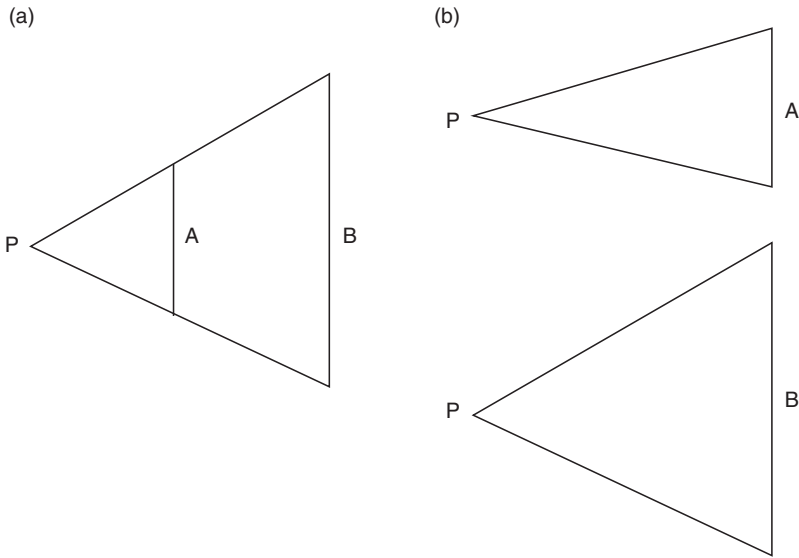


Figure 25. Visual angles for the perceiver (P) for objects A and B at different distances.

Descartes' account of the perception of location, distance, size, and shape is intricate and raises interpretive problems. In his time, visual theory was undergoing change, whether instigated by others or by Descartes himself.

Since antiquity, the perception of spatial properties such as size and shape had been theorized through the visual cone. This cone can be thought of with its apex in the eye and its base on the object seen. The distance to the object or the distances to its various parts are lines from the apex to the object. Depending on how far away an object is, its outer edges create a larger or smaller angle at the apex. Thus, a smaller object at a closer distance can subtend the same angle as a larger object farther away (Figure 25a), and objects of different sizes at the same distance subtend different angles (Figure 25b).

This **geometry** was reinterpreted in light of discoveries by **Johannes Kepler**. From each point on an object such as A or B (Figure 25), light is scattered and bathes the entire front of the eye. As Ibn al-Haytham realized, how each luminous point in the field of vision stimulates only one receptive point in the eye requires an **explanation**. Kepler's theory of the retinal image established a one-to-one correspondence between points on the object and points on the retina (see Figure 21). This required reinterpreting the visual cone, by extending its lines past the apex to subtend a portion of the retina. (In Figure 21, object VY is projected on the retina as RT, and the apex of the visual cone becomes a point in the eye at which constructed lines VR and YT cross.) For practical purposes, for a given visual cone the size of the image on the retina can be converted to a visual angle.

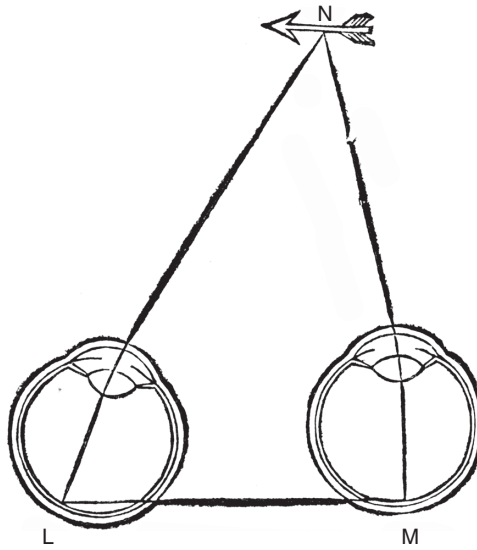


Figure 26. The triangle of distance perception for eyes L and M viewing object N (*Treatise on Man*, 1677).

Kepler's work affected accounts of the perception of the distance of objects from the eye. Previous theorists, such as Ibn al-Haytham, argued that cues to distance are learned in the course of life. If an object is recognized as having a known size (such as A in Figure 25b), then the distance could be perceived from the angle subtended by A: a larger angle means A is nearer (Ibn al-Haytham 1989, II.3.87–88). Kepler added a new factor in distance perception: the triangle formed by the eyes L and M, looking at object N (Figure 26). He realized that if the perceiver were acquainted with the size of the line segment LM and the angles NLM and NML, the size of the triangle specifies the distance to point N. In his scheme, perceivers learn by **habit** to use this information (Kepler 2000 [1604], ch. 3, prop. 8).

Kepler's (1611, prop. 64) results permitted another new source of distance information. He knew that the lens system of the eye must adjust or "accommodate" in order to keep the image on the retina in focus at differing distances. Kepler himself did not describe human perception as using this information, but Descartes did. In so doing, he invented a new type of explanation for distance perception: a purely psychophysiological account, in which a "sensing" or "seeing" of distance is directly produced in the mind by brain mechanisms that co-vary with ocular accommodation:

The seeing of distance depends ... in the first place upon the shape of the body of the eye. For as we have said, for us to see that which is close to our eyes, and to see what is farther away, this shape has to be slightly different. And as we change it in order to adjust the eye to the distance of objects, we also change

a certain part of our brain, in a way that is established by nature to allow our mind to perceive that distance. (AT VI 137, O 105–6)

The change in shape may pertain to the whole eye or to the lens alone (AT VI 108, O 85–86; AT XI 155–56, G 128). In any case, Descartes envisioned a brain mechanism that, through the natural laws of mind–body union, directly causes the visual perception of distance.

There are questions about whether Descartes attributed distance and size perception more generally to psychophysiological mechanisms, cognitive operations (whether innate or learned), or both. As for cognitive operations, he endorsed a point similar to al-Haytham's, proposing that we at least "imagine," if not "see," the distance of objects if we know their size (AT VI 138, O 107). Moreover, his Sixth Replies affirms that a cognitive account is the *sole* explanation for the perception of "size, distance and shape." Descartes there distinguishes three grades or levels of sense perception (AT VII 437–48, CSM II 295). First, there is the purely physical process of light reflecting from objects and affecting nerves in the retina and hence the brain. Second, there is "the mere perception of the color and light" reflected from the object. Descartes adds: "Nothing more than this should be referred to the sensory faculty, if we wish to distinguish it carefully from the intellect." The third grade consists in "a rational calculation about the size, shape and distance" of the object, which draws on the "extension of the color and its boundaries" (suggesting a two-dimensional sensation or array of light and color in the second grade). This third grade belongs to intellect (or judgment, including both intellect and will), but because it occurs rapidly and by habit (from childhood), it goes unnoticed and is integrated, phenomenally, with the experience of sense perception and so is assigned by Descartes to the third grade of sense.

The *Dioptrics* and *Treatise*, by contrast, apparently offer a psychophysiological account of distance perception, using the triangle relation described by Kepler. There is disagreement over whether, in the *Dioptrics*, Descartes described this relation as yielding distance perception through innate geometrical reasoning (Wilson 1993) or by a psychophysiological mechanism (Hatfield 1992). If this "natural geometry" is due to innate mental operations, these calculations go unnoticed because they are made "at great speed because of habit," as in the Sixth Replies (AT VII 438, CSM II 295). The *Treatise* suggests another way to think about this "natural geometry." Descartes explains that the position of the **pineal gland**, which he held to be the seat of mind–body interaction (see **human being**), might vary mechanically with the convergence of the eyes, thereby causing a perceiver to "sense" the distance to the object directly (AT XI 183–88, G 155–60), as in the case of accommodation (see **animal**, Figure 1.).

It seems likely that Descartes endorsed both types of account, cognitive as well as psychophysiological, for distance and size perception (Wolf-Devine 1993). How

he might integrate these two accounts within his theory of sense perception more generally is of ongoing interest.

See also *Dioptrics*; Human Being; Imagination; Intellect; Light; Optics; Quality, Sensible; Reason; Representation; Sensation; *Treatise on Man*

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GARY HATFIELD

PERSON

The term *persona* appears only once in the original Latin text of the *Meditations*, in the Fourth Meditation (AT VII 61, CSM II 43). There Descartes employs the term to mean “one’s role in life,” deriving from *persona* in the original theatrical sense of

“a mask,” as in the early *Private Thoughts* (AT X 213, CSMK I 2). Nowhere in the *Meditations* and *Objections and Replies*, or elsewhere in the published writings, does Descartes explain his conception of personhood or address the problem of “personal identity” that has exercised philosophers since **Locke**. It is all the more important therefore to determine what he took a “person” to be.

One suggestion that many commentators find appealing is that a Cartesian person is a **mind** or soul and thus that personal identity consists in sameness of soul (see, e.g., Thiel 2011, 270). In the Second Replies, on the question of whether **God** could be a deceiver, Descartes notes that in the *Meditations* he “had a special obligation” to talk about God in a philosophical way, “since there my supposition was that no other **human beings** were yet known to me, and moreover I was considering myself not as consisting of mind and **body** but solely as a mind” (AT VII 142–43, CSM II 102). The *Meditations* are primarily those of a *res cogitans*, not of a Cartesian human being, whose nature emerges in a letter to **Mesland** (February 9, 1645). When we talk about a human body, we do not mean just a determinate part of matter with a determinate size, but that part as united to the soul (*l’âme*). We believe that we have had the same body since infancy, despite its lifelong changes in quantity, **shape**, and composition. Our body is the same numerically (*idem numero*) because it is informed [*informé*] by the same soul (AT IV 166–67, CSMK 243). So is a Cartesian person a human being instead?

A human being, *qua* substantial union of a body and a mind, is still not a rounded *person*, because persons have moral and social commitments. Even in the *Passions of the Soul* (1649), Descartes explains that his purpose is “not to explain the passions as an orator, nor even as a moral philosopher, but solely as a physicist [*physicien*]” (AT XI 326, CSM I 7). In a letter to **Princess Elisabeth** (September 15, 1645), we learn significantly more:

Though each of us is a person [*une personne*] separate from the others, and whose interests consequently are in some way distinct from those of the rest of the world, still we ought to think that we could not subsist alone, and that each of us is in fact a part of the universe [*l’univers*], and even more particularly a part of this earth, a part of this state, of this society and this family to which we are joined through residence, through oath of allegiance, through birth. (AT IV 293, CSMK 266)

Today’s writers on personal identity ignore these textual matters, and mistakenly think that what they call “the Cartesian ego” is a candidate for personhood. A Cartesian person is not an *ego* or a *res cogitans*, but a social and moral human being, a substantial union of mind and body embedded in its everyday world. The identity through time of the continually changing body consists in its being informed by “the same soul.” The immortal soul enjoys eternal continuance as a **substance**, but

Descartes does not say in what else consists its identity through time as the soul *of this or that person* (McCann 1986). Still, it is safe to infer that the identity through time of each embodied *res cogitans* consists in its being individuated by its continually changing modal states, most of which result from its substantial union with “the same body” that it informs. The total history of these states, embedded in their social contexts, constitutes the uniqueness of each Cartesian person, a union of soul and body in relations of reciprocal modal determination.

See also Body; Human Being; Individuation; Mind; Soul, Immortality of the

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ALAN GABBEY

PETAU, DENIS (1583–1652)

Petau was a **Jesuit**, poet, classical scholar, controversialist, professor of philosophy, and theologian. This polymath humanist was admired by the much younger **Pierre-Daniel Huet**, who greatly resembled him. He was also much admired by Jacques-Benigne Bossuet, who defended him against the charges of Socinianism made by Pierre Jurieu. He practiced a form of “positive” theology, with careful attention to tradition and ancient sources. He had a bitter, extended debate over **free will** and grace with **Libertus Fromondus** (pseudonym Vincent LeDoux) and then with Amable de Bourgeis. He also attacked **Arnauld’s** *De la fréquente communion*, in what was an early round in the battle between the Jansenists and the **Jesuits**. His *De libero arbitrio* was an offprint from a later work, perhaps rushed into print as a Jesuit response to Jansenius’s *Augustinus* (1640). Despite all this, he was accused of **Jansenism** himself, an interpretive issue of relevance to his significance for Descartes.

He appears only twice, it would seem, in the Cartesian corpus. First, he is mentioned explicitly by name in a letter, probably written from Leiden to **Mesland** on May 2, 1644. Descartes says there that he has not read what Petau has written but

that, given how Mesland has explained himself on the **free will**, probably advancing Petau's views, there is not wide disagreement among them on the topic. A second text is taken by Adam and Tannery (AT IV 172) to be perhaps a letter to Mesland of February 9, wherein Descartes says, at the outset, that he fully agrees with the "Reverend Father." It is possible that the referent is **Guillaume Gibieuf**, as **Adrien Baillet** thinks (1691, 2:516), or Mesland, as others have thought, or someone else, but the rest of the paragraph, on indifference of the will, seems best to support the Petau hypothesis proposed by Étienne Gilson. In particular, the two notions of indifference deployed by Petau enable Descartes to agree with him that indifference in one sense is essential to the will, while maintaining that in his own, other sense, it is the lowest grade of freedom.

See also Arnauld, Antoine; Free Will; Huet, Pierre-Daniel; Jansenism; Jesuit; Mesland, Denis

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THOMAS M. LENNON

PHILOSOPHY

Descartes' conception of the scope of philosophy is decidedly more far-reaching than what is today considered to constitute the proper subject matter of the discipline.

Many areas of study that we now classify as distinct from philosophy were thought by Descartes and his contemporaries to fall under the broad heading of *natural philosophy*. Indeed, a quick look at the subjects covered by Descartes in his *Principles of Philosophy* (1644) reveals the wide range of phenomena that he believed to be the proper purview of the philosopher. While part I discusses the sorts of matters contemporary philosophers associate with Descartes and see as distinctly philosophical, part II would today be classified as a work in **physics**. Part III deals with questions concerning the moon, sun, planets, comets, and other topics that today we see as part of astronomy; and the final division, part IV, takes up all sorts of matters, none of which would be thought of as a matter for *philosophical* investigation today. In it, Descartes treats such diverse topics as the nature of air, the tides, the interior of the earth, qualities of various salts, and why earthquakes occur, as well as answers to several dozen questions about fire and even more about magnets (see **magnetism**).

In the preface of the 1647 French edition of the *Principles*, Descartes famously compares philosophy to a tree in order to show the internal divisions of, and the relations between, the subdisciplines of the field. In the metaphor, the “roots are **metaphysics**, the trunk is physics, and the branches emerging from the trunk are all the other sciences, which may be reduced to three principled ones, namely **medicine**, **mechanics**, and morals” (AT IXB 14, CSM I 186). There is, thus, a *dependence* relation among the subdisciplines: just as the trunk depends upon the roots for support, for example, physics relies on the principles of metaphysics. But the tree metaphor also suggests that there is an *order* in which philosophy ought to proceed – the roots must come *before* the trunk and the branches. This point comes out later in the preface, where we are given an explicit statement of Descartes’ understanding of philosophy. Philosophy, he says, has as its object wisdom, and by “wisdom” he means “not only prudence in our everyday affairs but also a perfect **knowledge** (*parfaite connaissance*) of all things that mankind is capable of knowing, both for the conduct of life and for the preservation of health and the discovery of all manner of skills.” This “perfect knowledge,” which Descartes calls *scientia* in his Latin writings and which he characterizes as wholly impervious to **doubt**, can be attained, he claims, only by beginning from first principles, the search for which being what “the term ‘to philosophize’ strictly refers” (AT IXB 2, CSM I 179).

These first principles possess two essential features: they are indubitable to an attentive **mind**, and all other knowledge depends on them in such a way that none of it can be known without first knowing the principles. Thus, in keeping with the tree metaphor, we are here told that philosophy must proceed according to a certain order; it must begin with what is known with **certainty**, and these first truths in turn support that which follows from them. That said, Descartes holds that philosophy in this strict sense is something one should do only “once in a lifetime” (*semel in vita*). As he tells **Princess Elisabeth**, “it would be harmful to occupy one’s **intellect** frequently in meditating upon” these principles. Better, he advises, is to “employ

the rest of one's study time to thoughts in which the intellect co-operates with the **imagination** and the senses," that is, presumably, medicine, mechanics, and morals, as well as the subject matter of philosophy as understood in his broader sense (see AT III 695, CSMK 228; AT VII 17, CSM II 12).

These two points, namely, the importance of starting with what one knows to be true and then proceeding in the correct order, are endorsed explicitly in *Principles* I, where Descartes writes that success in philosophy can be achieved only if we "lay aside all our preconceived opinions [or **prejudices**], or at least we must take the greatest care not to put trust in any of the opinions accepted by us in the past until we have first scrutinized them afresh and confirmed their **truth**." Once we have done this, we need to "give our attention in an orderly way," proceeding from these ideas whose truth is understood clearly and distinctly to what is entailed by them (AT IXB 38, CSM I 221). If we are careful to attend to these **deductions**, admitting only what follows necessarily from the previous steps, Descartes believes we will preserve certainty within the entirety of our philosophical system.

Mention should also be made of what Descartes says philosophy is *not*. It is not the acceptance, critical or uncritical, of philosophical systems from the past, especially, but not limited to, the Aristotelianism of the Scholastics. Rather, philosophy involves taking nothing on the authority of others and discovering truth for oneself. In the *Discourse on Method*, he offers another metaphor, likening the correct approach to philosophizing as akin to the actions taken by people who rebuild their houses "when the houses are in danger of falling down and their foundations are insecure" (AT VI 13, CSM I 117). Speaking of the various opinions that he had accepted over the years without first questioning them, he says that he thought it best to

undertake to get rid of them, all at one go, in order to replace them afterwards with better ones, or with the same ones once I had squared them with the standards of **reason**. I firmly believed that in this way I would succeed in conducting my life much better than if I built only upon old foundations and relied only upon principles that I had accepted in my youth without ever examining whether they were true. (AT VI 13–14, CSM I 117)

Finally, Descartes understood philosophical thinking as an activity that has important benefits for the practitioner. Making use of yet another metaphor, this time vision, he writes in the *Principles* that "living without philosophizing is exactly like having one's eyes closed without ever trying to open them; and the pleasure of seeing everything which our sight reveals is in no way comparable to the satisfaction accorded by knowledge of things which philosophy enables us to discover" (AT IXB 3, CSM I 180). But it is not merely a matter of pleasure – there are important practical implications for the life of the philosopher. Descartes claims that philosophy is

needed for proper moral conduct even more than our eyes are needed for successfully navigating our environment. The wisdom attainable from doing philosophy is, he tells us, “the true food of the mind” (AT IXB 4, CSM I 180).

See also Analysis versus Synthesis, Knowledge, Metaphysics, Method, *Principles of Philosophy*, Scholasticism

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PHYSICO-MATHEMATICS

In November 1618, Descartes, then twenty-two, met and worked for two months with **Isaac Beeckman**, a Dutch scholar seven years his senior. Beeckman was one of the first supporters of a corpuscular-mechanical approach to natural philosophy. However, it was not simply corpuscular mechanism that Beeckman advocated to Descartes. He also interested Descartes in what they called “physico-mathematics.” In late 1618, Beeckman (1939–53, I:244) wrote, “There are very few physico-mathematicians,” adding, “(Descartes) says he has never met anyone other than me who pursues enquiry the way I do, combining Physics and Mathematics in an exact way; and I have never spoken with anyone other than him who does the same.” They were partly right. While there were not many physico-mathematicians, there were of course others, such as **Kepler**, **Galileo**, and certain leading **Jesuit** mathematicians, who were trying to merge mathematics and natural philosophy (Dear 1995, 168–79).

Physico-mathematics, in Descartes’ view, deals with the way the traditional mixed mathematical disciplines, such as **hydrostatics**, statics, geometrical **optics**, geometrical astronomy, and harmonics, were conceived to relate to the discipline of natural philosophy. In Aristotelianism, the mixed mathematical sciences were interpreted as intermediate between natural philosophy and **mathematics** and subordinate to them. Natural philosophical explanations were couched in terms of **matter**

and **cause**, something mathematics could not offer, according to most Aristotelians. In the mixed mathematical sciences, mathematics was used not in an explanatory way, but instrumentally for problem solving and practical aims. For example, in geometrical optics, one represented **light** as light rays. This might be useful but does not facilitate answering the underlying natural philosophical questions: “the physical nature of light” and “the causes of optical phenomena.” In contrast, physico-mathematics involved a commitment to revising radically the Aristotelian view of the mixed mathematical sciences, which were to become more intimately related to natural philosophical issues of matter and cause. Paradoxically, the issue was not mathematization. The mixed mathematical sciences, which were already mathematical, were to become more “physicalized,” more closely integrated into whichever brand of natural philosophy an aspiring physico-mathematician endorsed.

Three of Descartes’ exercises in physico-mathematics survive. The most important is his attempt, at Beeckman’s urging, to supply a corpuscular-mechanical explanation for the hydrostatic paradox, which had been rigorously derived in mixed mathematical fashion by Simon Stevin (AT X 67–74, 228; Gaukroger and Schuster 2002). Descartes’ physico-mathematical work on **hydrostatics** involves a radically non-Aristotelian vision of the relation of the mixed mathematical sciences to his emergent form of corpuscular mechanical natural philosophy. Descartes aims to shift hydrostatics from mixed mathematics into the realm of natural philosophy. He believed that from crisp, simple geometrical representations of *sound*, mixed mathematical results one can read out or “see” the underlying corpuscular mechanical causes.

Descartes and Beeckman’s studies of **accelerated free fall** also belong to their physico-mathematical project. They did not achieve any agreed results, because they could neither settle on what the correct, geometrically expressed law of falling bodies is nor discern firm clues about its underlying causes (AT X 58–61, 74–78, 219–22). The failed physico-mathematicization of falling bodies reverberates later in Descartes’ distrust of the scientific relevance of Galileo’s announcement of a mathematical law of accelerated free fall.

Descartes’ third physico-mathematical exercise showed more promise, stalling in the short run, although it yielded rich results later. In 1620 he attempted in a physico-mathematical manner to find the law of refraction of light by considering the geometrical representation of its likely causes. He based the endeavor on passages and diagrams in which Kepler suggests that light moves with more force in denser optical media and “hence” is bent toward the normal in moving from a less to a more dense medium (AT X 242–43). On this occasion, Descartes found neither a law of refraction nor its natural philosophical causes. However, seven years later, while working with the mathematician **Claude Mydorge**, he found, by traditional mixed mathematical means, a simple (cosecant) version of the law of refraction. Descartes immediately set to work attempting, in a physico-mathematical manner, to read out of his key geometrical diagram the principles of a mechanical theory of light that

would then subsume the new geometrical law that had prompted them. These developments in turn had large consequences for the system of corpuscular-mechanical natural philosophy he first developed in *The World* (1633): Descartes' ideas about mechanistic optics, themselves physico-mathematical in tenor, suggested key concepts of his dynamics of corpuscles, which in turn helped shape his theory of vortices.

See also Beeckman, Isaac; Cause; Hydrostatics; Light; Mechanics; Optics; *Private Thoughts*; Vortex

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JOHN A. SCHUSTER

PHYSICS

Descartes does not often use the word "physics" (*physica*, *physicos*, or *physique*) in his writings. Perhaps his boldest and most famous pronouncement about physics comes in the preface to the 1647 French translation of his *Principles of Philosophy* (1644). There he explains what a man must do to apply himself to "True Philosophy." He first must study **metaphysics**, and then, the

second [thing he must study] is Physics, in which after having discovered the true Principles of material things, one examines, in general, the composition

of the whole universe, and then, in particular the nature of this earth and of all the **bodies** which are most commonly found around it, like air, water, fire, the lodestone, and other minerals.... **Philosophy** as a whole is like a tree; of which the roots are Metaphysics, the trunk is Physics and the branches emerging from the trunk are all the other branches of **knowledge** ... [namely,] **Medicine**, **Mechanics** and Ethics. (AT IXB 14, MM 24)

Parts II, III, and IV of the *Principles* are partly dedicated to “Physics,” yet well before 1644 Descartes was engaged with physical problems and seems to have begun his work in “physics” with his *Dioptics*, which was composed in the early 1630s. However, in his **correspondence**, the first work he sometimes refers to as “my Physics” is found in *The World* (see, e.g., AT I 348, CSMK 52). In both the physics of *The World* (1633) and of the later *Principles*, Descartes lays out a general account of matter and **motion** as well as a **vortex** theory of planetary motion. In what follows, the notable differences in how Descartes approaches some of the same issues in these two works are highlighted.

In *The World*, Descartes outlines his physics in a quite realistic manner. He lists three basic elements (fire, air, earth), which can be used to explain all natural phenomena by means of the “motion, size, **shape** and the arrangement of ... [their] parts” (AT XI 26, G 18). Descartes also writes:

I do not pause to seek the **cause** of [their motion], for it is enough for me to take it that they begin to move as soon as the world began to exist. And that being the case, I reason that their motions cannot possibly ever cease, or even change in anyway except in respect of their subject. That is to say, the strength or power found in one body to move itself may pass wholly or partially into another body and thus no longer be present in the first, but it cannot entirely cease to exist in the world. (AT XI 11, G 9)

The proposal that bodies have a “strength or power” to move offers a rather clear affirmation that motion is something quite real and is present in bodies themselves (see **force and determination**).

That bodies possess active powers in their nature is also later affirmed in the *Meditations on First Philosophy* (1641). Here, as Descartes is attempting to prove the **existence** of the external world, he writes:

For **God** has plainly given me no **faculty** at all for recognizing any such sources for these **ideas** [of sensible bodies]; on the contrary, he has given me a tendency to believe they are transmitted [*emitti*] by corporeal things. So I do not see how God could be understood as anything but a deceiver if the ideas were transmitted [*emitterentur*] from a source other than corporeal things. (AT VII 79–80, CSM II 55)

The realist position offered here is emphasized earlier in the same paragraph where he says the cause of these ideas of sensible things must be “something active” (*quaedam activa*).

By the time of the first Latin edition of the *Principles*, this realist position about motion and the proposal that active powers reside in bodies have radically changed.

I. PHYSICS IN *PRINCIPLES*, PART II

Most of what has been written about Descartes’ physics in recent scholarship has dealt with part II of the *Principles*, “Of the Principles of Material Objects.” There have been many controversies about how to interpret certain passages in this text. In what follows, we focus on the main areas that have provoked controversy without trying to adjudicate among interpretations.

Descartes claims early in part II that the nature of body consists in **extension** alone (II.4). He goes on to consider the nature of internal place, or space, and then external place (see **place, external versus internal**). The internal place just is a body’s extension, whereas external place is determined by the relations one body has to other, immediately contiguous bodies. He then argues that there can be no **vacuum**, no **atoms**, and no plurality of worlds. Importantly, he also contrasts the ordinary sense of *motion* as “an action (*actio*) by which a body travels from one place to another” (II.24) with what movement properly speaking is, namely, “the transference of one part of matter or of one body, from the vicinity of those bodies immediately contiguous to it and considered as at rest, into the vicinity of [some] others” (II.25). Motion then, properly speaking, is “a transference, not the force or action which transfers” (II.25; AT VIIIA 53–54, MM 51). This follows from Descartes’ definition of body: if a body is just extension in three dimensions, then a body can have no internal active force as part of its nature. Motion is only a **mode** of matter.

Descartes realizes that the transference that defines motion is always reciprocal (II.29). Namely, when two bodies are separating, one cannot truly say which of them is “really” moving. This follows from his claim that “all the real and positive properties which are in moving bodies, and by virtue of which we say they move, are found also in those contiguous to them” (II.30; AT VIIIA 57, 236, MM 53).

In part II, and reminiscent of what is claimed in chapter 7 of *The World*, God is presented as the universal and primary cause of motion, and, by Descartes’ conservation principle, there is a fixed and determinate amount of motion in the universe (II.36) (see **conservation of motion, principle of**). From this Descartes establishes his three **laws of nature**:

1. That each thing, as far as in its power, always remains in the same state (II.37).

2. That all movement is, of itself, along straight lines (II.39).
3. That a body, upon coming into contact with a stronger one, loses none of its motion; but that upon coming in contact with a weaker one, a body loses as much as it transfers to that weaker body (II.40).

Descartes then proceeds to elaborate six rules of collision, rules that apply only to two bodies coming into contact with each other. This idealization is what allows him to calculate the equilibrium that must result from any two-body collision. The equilibrium is an application of the conservation of total motion (which derives from God's immutability) to two-body systems. It was quickly pointed out by critics such as **Christiaan Huygens** that Descartes' rules of collision are inconsistent.

At the end of part II, Descartes considers fluid versus solid bodies and details how motion occurs in fluids. This will be important for him later in part III when he puts forward again his **vortex** theory of the heavens, according to which the celestial bodies are carried about in fluids having a vortical motion (see **hydrostatics**).

2. THE "APPLIED" PHYSICS IN *PRINCIPLES*, PART III

Having "discovered the true principles of material things" in part II, namely, the conservation principle and three laws of nature, Descartes turns in part III to what we could fairly call his physics proper. In line with his remarks in the French preface, his project in part III is to examine, "in general, the composition of the whole universe" and, specifically, the motion of the earth, sun, and other planets. In this fluid heaven, the earth is carried around the sun by being embedded in a vortex. But, properly speaking, he argues that the earth does not move since it does not change place with regarded to those parts of the fluid immediately contiguous to it. The earth is being carried along by this fluid as a piece of wood might be carried by a wave.

Later in part III he gives details about how the planetary vortices work in carrying the planets around the sun. After this he introduces his hypotheses about the particles that are fundamental to understanding how the mechanisms of the world work to produce observable phenomena, such as "heavy" bodies falling toward the earth. He also goes to great length to explain the natures of water and fire in terms of the particulate mechanisms.

3. THE METHODOLOGICAL SHIFT IN DESCARTES' PHYSICS, 1632 TO 1644

Consistent with the general project of the *Principles*, the primary goal of part III is to identify those causes, or principles, from which the natural phenomena we

experience (i.e., the planetary motions that we witness) can be “deduced.” However, the causes we invoke in the **explanations** of these phenomena should be “taken only as hypotheses” (III.44). They are hypothetical because knowing the true causes at work in the heavens, and in nature in general, would require knowing precisely how God created the world – and knowing, in particular, the specific sizes, speeds, and motions that God imparted onto the physical world at the moment of creation. Such **knowledge** of God’s creative activity exceeds our human comprehension, and thus, in physics, we are to “devise some principles which are very simple and easy to know” (III.45), from which we can deduce explanations that “are entirely in conformity with the phenomena” (III.44; AT VIIIA 99–100, MM 105–6).

Importantly, then, Descartes is not invoking a standard of **truth** as he proceeds with his physics. Rather, in his search for the causes that explain the phenomena of nature, he is guided by the standards of intelligibility, explanatory power, and consistency: the principles of the visible universe must be “simple and easy to know”; they must serve to explain what appears “both in the heaven very far from us” and in “the things we see very close to us and which affect us more noticeably” (III.42; AT VIIIA 98–99, MM 104); and they must be consistent with God’s general and immutable conservation of nature, as expressed in the laws of nature that were established in part II. This final point is clarified in III.46. Descartes first reiterates what was established in part II, namely, that God created a single kind of matter that is divisible and endowed a circular motion, the **quantity** of which is conserved in nature. He then hypothesizes that: (1) “God, in the beginning, divided all the matter of which He formed the visible world into parts as equal as possible and of medium size”; (2) God “endowed [the parts of matter] collectively with exactly that amount of motion which is still in the world at present”; and (3) God “caused them all to begin to move with equal force in two different ways, that is, each one separately around its own center ... and also several together around certain other centers equidistant from each other” (AT VIIIA 101, MM 106–7). These three “very simple and easy to know” principles, or hypotheses, guide the remainder of Descartes’ physical inquiry, including the details of his vortex theory of the heavens.

Notice that, in part III, Descartes claims that hypotheses are a necessary feature of physical reasoning, because we have limited insight into how God created the world. These hypotheses, in contrast to the laws of nature, are not intended to be “entirely in conformity with the truth” (III.19; AT VIIIA 86, MM 91). Yet, as genuine explanatory principles, they must be consistent with those previously established, metaphysically certain truths of part II. This marks an evident shift from Descartes’ use of similar principles in his earlier *The World* (see chs. 6 and 7). His goal in that work is to explain the main features of his metaphysics, so he introduces the three laws of nature as part of a fable that details God’s very creation of matter and motion.

See also Atom; Body; Cause; Conservation of Motion, Principle of; *Dioptrics*; Experiment; Explanation; Extension; Force and Determination; Gravity;

Hydrostatics; Inertia; Law of Nature; Magnetism; Mechanics; Motion; Optics; Physico-Mathematics; Place, External versus Internal; Plenum; *Principles of Philosophy*; Shape; Vacuum; Vortex; *The World*

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PETER MACHAMER AND MARY DOMSKI

PICOT, CLAUDE (1601–1668)

Picot was born at Moulins as the eldest son of a tax officer and died in the small town of Limeil. Although he seems to have frequented libertine circles, he entered

the church and was appointed prior of the Abbey of Le Rouvre. Together with two libertine friends, Picot visited Descartes in the Netherlands in 1641. He familiarized himself with Cartesian **philosophy** – which, Descartes suggests, led to Picot’s “conversion” to his **metaphysics** (AT III 340) – and temporarily settled in Utrecht where he was introduced to Descartes’ **mathematics**. When Picot returned to France in November 1642, he started a **correspondence** with Descartes, most of which is now known only through the abstracts and short quotations by **Adrien Baillet**. The correspondence was personal and intimate, discussing details such as Descartes’ health, diet, and dress. It shows that Picot often assisted Descartes in financial matters and that Descartes roomed with Picot while in Paris in 1644 and 1647. Almost immediately after the publication of the *Principles* (1644), Picot began a French translation of it, published in 1647. He was also involved in the distribution of Descartes’ *Passions of the Soul* (1649) in France and seems to have written two of the four letters that form the preface to that work.

See also Baillet, Adrien; *Principles of Philosophy*; *Passions of the Soul*

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ROGER ARIEW

PINEAL GLAND

In the *Discourse on Method*, Descartes writes that in order to constitute a real man, a rational soul cannot derive from matter. Nevertheless, it must be “closely joined and united with the **body**” (AT VI 59, CSM I 141). The expression “real man” echoes the *Treatise on Man* (AT XI 202, CSM I 108), and is also found later in the *Sixth Meditation* (AT VII 90, CSM II 62). In this meditation, Descartes writes that “the **mind** is not immediately affected by all parts of the body, but only by the brain, or perhaps just by one small part of the brain, namely the part which is said to contain the common sense” (AT VII 86, 90; CSM II 59, 62). The *Discourse* had mentioned the “**common sense**” (AT VI 55, CSM I 139), as had the *Dioptrics*, where its “seat” is located in a “small gland ... in the middle of the concavities” in the brain (AT VI 129). In the *Passions of the Soul*, Descartes writes that this gland is the part of the body where the soul “exercises its functions more particularly than in all the others.” Descartes is referring to the pineal gland or conarium, which he calls “the principal seat of the soul” (AT XI 351–52, CSM I 340).

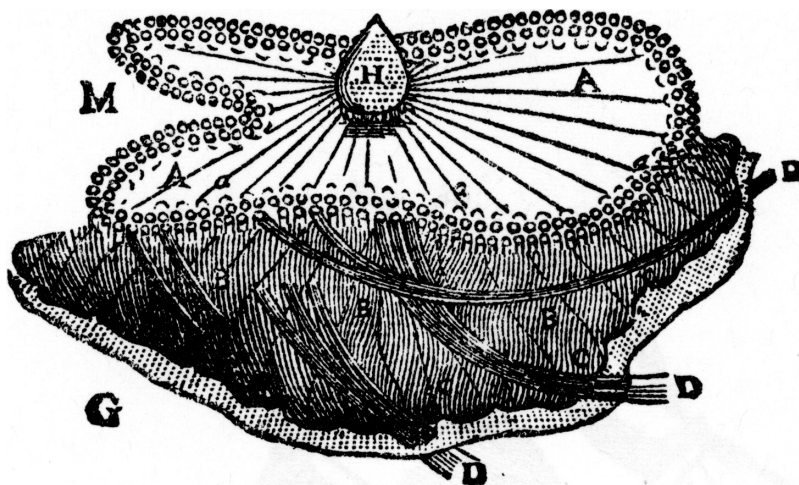


Figure 27. Pineal gland (*Treatise on Man*, 1664).

This gland, already mentioned by the physician Galen and, owing its name to its pinecone shape (*De usu partium*, book VIII, ch. XIV), is denominated by the letter “H” in the *Treatise on Man* (AT XI, 176, CSM I 106) (see Figure 27). This letter identifies the pineal gland in a Vesalian-style anatomical plate dealing with the internal structure of the brain in Caspar Bauhin’s treatise *Theatrum anatomicum*, a book that was of use to Descartes when he was writing the *Treatise on Man* and “was dissecting the heads of various **animals**” to “explain what **imagination**, **memory**, etc. consist of” (AT I 263, CSMK 40). Descartes clearly distinguishes this gland from the pituitary gland or hypophysis, located at the base of the brain (AT III 263, CSMK 162; AT XI 270, 582). He also rejects the “processus vermiformis” (or vermis) of the cerebellum to be a suitable organ devoted to the union (AT III 124).

The function that Descartes assigns to the pineal gland is original. Owing to its situation in the middle of the concavities in the brain, and because it is unique in the brain, most of whose parts are paired, this gland is “the principal seat of the soul, and the place in which all our **thoughts** are formed,” (AT III 19–20, 47–48, CSMK 143, 145–46; also see AT XI 352, CSM I 340). Being “the seat of the common sense, that is to say the part of the brain in which the soul performs all its principal operations,” or “the seat of thought, and consequently of the soul,” this soft and small gland is “mobile” to “receive all the impressions which come from the senses” and is “movable” only by the **animal spirits** (subtle particles of the blood) that transmit these impressions (AT III 263–64, 362, CSMK 162, 180). This gland is “surrounded by the little branches of the carotid arteries which bring the spirits into the brain” (AT III 20, CSMK 143). It should be noted that “no nerve goes to the conarium” (AT III 361, CSMK 180), an anatomical **explanation** given by Descartes and ignored by many commentators, such as Schuyl (Latin version of the *Treatise on Man*) and Willis

(1664). From the *Treatise on Man* to the *Passions*, this gland can also be moved by “the force (strength) of the soul” (AT XI 180; AT XI 356, CSM I 342).

The pineal gland is fragile and rapidly found decayed when bodies are dissected (AT III 48–49, CSMK 146). Despite its fragility and small size, Descartes observed it when dissecting the brains of “freshly killed animals,” especially a lamb (AT XI 582; AT III 48–49, CSMK 146), where the gland is larger than in man (AT III 20, CSMK 144).

The crucial Cartesian turn was to dissociate the soul from vital phenomena at a time when the vital soul still played an important part in **medicine**. Physicians and surgeons wrote that the soul gives “life and movement to the body,” and they mentioned the existence in **human beings** of the vegetative soul, the sensitive soul, and the rational soul, an echo of the three powers in Aristotelian philosophy. These topics were traditionally dealt with in commentaries on Aristotle’s *De Anima* and *Parva naturalia*. They were linked with attempts to localize in the brain the mental **faculties**, including the internal senses such as memory, imagination, and **reason**, and to connect these faculties, especially imagination and “phantasia,” with the “**common sense**” (*sensus communis*), which in **Scholasticism** and in medical treatises was supposed to unify the impressions conveyed by the five external senses.

Descartes was aware of this complex context. In the *Treatise*, he explains that the pineal gland is involved in bodily movements even in a mindless **machine** and that, when a soul is placed in the body, it will “sense different objects through the mediation of the same organs similarly arranged, no change occurring other than in the situation of the gland” (AT XI 183). Thanks to the flow of the animal spirits toward the fibrous structure of the brain, an image is reflected on the surface of the pineal gland (AT XI 356, CSM I 342), and the spirits “draw” the gland (AT XI 185, 188). The Sixth Meditation insists on the union and on the “vital signification of sensations” in the cogent phrase of Geneviève Rodis-Lewis. For Descartes, man is “a combination of mind and body” and is taught by nature “to avoid what induces a feeling of pain and to seek out what induces feelings of pleasure” (AT VII 82, IXA 65; CSM II 57; cf. *Passions*, AT XI 372, CSM I 349). **Passions** of the soul are “**sensations**” because they are received into the soul in the same way as the objects of the external senses” (AT XI 350, CSM I 339), and Descartes’ last treatise explains “how the soul and the body act on each other” (AT XI 354–55, CSM I 341).

Hence, the pineal gland is linked with the union of a soul to a body (see **human being**) and with the analysis of sensations and passions. The **correspondence** with **Princess Elisabeth** shows that the union has to be considered in itself, as a third “**primitive notion**,” in addition to the notions of body and soul. Descartes holds that “all human **knowledge** consists solely in clearly distinguishing” these primitive notions (AT III 665–66, CSMK 218). He also insists that the union of mind and body is something we “experience within ourselves” (cf. *Principles* I.48, AT VIIIA 22–23, CSM I 208–9).

The name of “glandula pinealis” can be found in **Henricus Regius’s** *Physiologia* (1641), much influenced by Descartes’ *Dioptrics* and his letters. At the beginning of the same year, an affirmative answer to the question “Is the pineal gland the seat of the common sense?” was defended as a thesis in Paris (École de médecine). An allusion to the thesis is found in one of Descartes’ letters to **Mersenne** (AT III 263, CSMK 162). This thesis shows the confusion that prevailed in medical studies at that moment. The last sentence in its last paragraph is Cartesian: “Therefore the conarium is the seat of the common sense.” But most of the other paragraphs, including the opening one, about the soul being divided into “vegetans, sentiens, intelligens,” are in opposition to the *Discourse* and the *Dioptrics*. Yet in the thesis there is no allusion to these texts, and the conclusion is directed against Aristotle, who located the common sense in the **heart**, against “the Arabs,” who located it in the anterior part of the brain, and against the “Metoposcopi,” who located it on the forehead.

The role of the pineal gland was discussed in the seventeenth century by other physicians (besides Regius) as well, including Thomas Bartholin, **Louis de La Forge**, and Thomas Willis, and by philosophers such as **Leibniz**, **Malebranche**, **Henry More**, and **Spinoza**. Contemporary science has demonstrated that the pineal gland or epiphysis is attached to the substance of the brain and that it belongs to the endocrine system that produces hormones, most notably melatonin, which influences the circadian rhythm.

See also Anatomy and Physiology; Animal; Animal Spirits; Body; Common Sense; *Description of the Human Body*; Dualism; Experiment; Human Being; La Forge, Louis de; Mind; *Passions of the Soul*; Perception; Primitive Notion; Regius, Henricus; Sensation; *Treatise on Man*

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PLACE, EXTERNAL VERSUS INTERNAL

In the *Principles of Philosophy* (1644), part II, Descartes introduces a distinction between “space or internal place,” which he equates with “the size and **shape** of a **body**” and “external place,” defined as “the surface immediately surrounding what is in the place.” The latter **definition** looks at first sight very similar to the one found in Aristotle’s *Physics* IV, 4, where place is identified with the limiting surface of the surrounding body.

In the *Rules for the Direction of the Mind* (1628), Descartes had explicitly taken issue with the Aristotelian notion of place on the ground that “the surface of the surrounding body can change, even though I do not move or change my place; conversely, it may move along with me, so that, although it still surrounds me, I am no longer in the same place” (AT X 427, CSM I 40; cf. AT X 433, CSM I 53). In the Sixth Replies, Descartes endorsed the Aristotelian definition of place but avoided the difficulty raised in the *Rules* by defining “surface” not as a **substance**, but as a **mode**, which “cannot be a part of a body.” This means that “the place where a tower is does not change even though the air which surrounds it is replaced, or even if another body is substituted for the tower” (AT VII 433–34, CSM II 292–93).

Similarly, in the *Principles* II.15 one reads that “surface” does not mean “any part of the surrounding body, but merely the boundary between the surrounding and surrounded bodies, which is no more than a mode” and which “is always reckoned to be the same provided it keeps the same size and shape” (AT VIIIA 48–49, CSM I 229). But given that in *Principles* II.10 the “size and shape” of a body are identified with its internal place, it would seem as if the external place could change only if the internal place also changes. According to Thomas Lennon, Descartes maneuvers himself into an Eleatic position: “**Motion** occurs with change in external place; external place changes when there is change in internal place; but change in internal place is impossible.... Hence there is no real motion” (Lennon 2007, 37–38). In *Principles* II.10 and II.12, however, Descartes explains that there is a sense in which the internal place of a body can be said to change. **Extension**, considered as “something particular” changes whenever a body is removed. “But in the case of a space, we attribute to the extension only a generic unity, so that when a new body comes to occupy the space, the extension of the space is reckoned not to change ... so long as it retains the same size and shape and keeps the same position relative to certain external bodies which we use to determine the space in question” (AT VIIIA 45, CSM I 227; see also AT VIIIA 47, CSM I 228). According to some scholars, these lines suggest that the relation between a body and its internal place is the same as that between a particular extension and the extension common to all bodies (de Buzon and Carraud 1994, 58–59; Garber 1992, 136). According to another interpretation, Descartes argues that there are two different ways in which a body and a space retain their identity through **time**: while a body is always linked to a particular location, the identity of a space is preserved if many different bodies occupy a given

volume, but not simultaneously. In other words, the identity of corporeal and spatial extension does not imply that a particular place is identical with a particular body (Zepeda 2009, 25–37).

One may wonder why Descartes takes pain to redefine the Scholastic concepts of internal and external place, which after all play a fairly marginal role in his **physics**. The answer to this question becomes clear if one looks at Descartes' account of **transubstantiation**. The definition of "external place" as a "surface" that "cannot be a part of a body" enables Descartes to explain how, after the consecration of the host, the body of Jesus Christ comes to occupy the place of the bread. As Descartes explains in a letter to **Mesland**, the surface between the air and the body of Christ is "numerically the same" as that between the air and the bread, because "numerical identity does not depend on the identity of the bodies ..., but only on the identity or similarity of the dimensions" (AT IV 164–65, CSMK 242). According to Descartes, the only thing that is preserved in transubstantiation is the "surface," that is to say, the "external place," which being a "mode" does not belong to the substance of the bread (de Buzon and Carraud 1994, 60–64).

As noted already, the concepts of internal and external place are of little use in the second part of the *Principles*. When Descartes sets out to define "motion" (*Principles* II.24–25), he substitutes the technical notion of "vicinity" for that of "external place." He explains that "motion, in the ordinary sense of the term, is simply *the action by which a body travels from one place to another*," whereas properly speaking it is "*the transfer of one piece of matter, or of one body, from the vicinity of the other bodies which are in immediate contact with it, and which are regarded as being at rest, to the vicinity of other bodies*" (AT VIIIA 53–54, CSM I 233).

According to the vulgar definition, the same body can be said to be moving and not moving at the same time (e.g., a person can be in motion relative to the shore, but at rest relative to the ship [AT VIIIA 53, CSM I 233]), and also to partake in different motions simultaneously (e.g., the wheels of a watch, while turning, also share in the motion of the a ship and in that of the earth [AT VIIIA 57, CSM I 236]). According to the proper definition, however, a body can have only one motion at the time (e.g., the turning motion of a watch's wheels), "given that only one set of bodies can be contiguous with the same body at any one time" (AT VIIIA 55, CSM I 234–35). But is it possible, on the basis of the proper definition, to determine whether a body is in motion or at rest? Descartes' statements that a change of "external place" can be determined only in relation to "external bodies which are regarded as immobile" (AT VIIIA 48, CSM I 229) and that the transference of motion "is itself a reciprocal process" (AT VIIIA 55, CSM I 235) were often interpreted as a commitment to a relational theory of motion (Leibniz 1969, 393; Newton 2004, 14–16; Prendergast 1972). According to Garber (1992, 167), however, "the reciprocity of transfer that Descartes clearly acknowledges" is compatible "with a genuinely objective distinction between motion and rest." In *Principles* II.27, Descartes asserts, in fact, that motion and rest

are “two different modes of a body” and that “when there is transfer of motion, the body is in a different state from when there is no transfer” (AT VIII A 55, CSM I 234).

A note written shortly after the *Principles*, clarifies that “motion and rest differ truly and modally if by motion is understood the mutual separation of two bodies and by rest the lack of this separation. However, when one of two bodies which are separating mutually is said to move, and the other to be at rest, in this sense motion and rest differ only in reason” (AT XI 656–57, quoted in Garber 1992, 167). In Garber’s view, Descartes wants to make the following point: although it is arbitrary whether a body A is at rest in the vulgar sense, once we consider it to be at rest, we can regard another body as being really in motion if it is separating from A. In other words, “the arbitrariness that attaches to the vulgar notion does not undermine the distinction between motion and rest properly understood” (Garber 1992, 169). Dennis Des Chene agrees with Garber that Descartes’ view is consistent. Cartesian motion is reciprocal, but not relative, and those passages where Descartes “seems to be acknowledging the relativity of motion turn out to be passages in which he rejects the vulgar notion of ‘place’ on which the supposed relativity is founded” (Des Chene 1996, 256).

See also Body; Earth, Motion of the; Extension; Individuation; Leibniz, Gottfried Wilhelm; Mode; Motion; Newton, Isaac; Shape

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PLEMPIUS (PLEMP), VOPISCUS FORTUNATUS (1601–1671)

Born in Amsterdam as the son of a wealthy Catholic family, Vopiscus (a name usually given to the surviving half of a twin) Plempl was educated by the **Jesuits** at Ghent and studied at Louvain (with **Fromondus**) and Leiden (with **Vorstius**), before embarking on a European tour, which brought him to Padua and Bologna. After taking his medical degree at Bologna (1624), he started a medical practice at Amsterdam. In 1633 he was appointed professor of **medicine** at Louvain, where after a successful career he also died. Plempl was a very learned man who, thanks to his knowledge of oriental languages, could enrich the Galenic tradition with elements from Arabic medicine.

Plempl knew Descartes during the latter's Amsterdam years (1630–31). They became friends, and Descartes turned to him to collect the objections he originally planned to publish as a sequel to the *Discourse on Method* and “essays” (1637). Apart from the objections written by himself, Plempl was also Descartes' intermediary with his Louvain colleagues Fromondus and Ciermans. In his own objections, Plempl concentrated on the circulation of the blood and the movement of the **heart**. Although in the course of his **correspondence** with Descartes, Plempl gradually came round to the ideas of **William Harvey** (1578–1657) on the circulation of the blood (Descartes even offered to add a note to the effect that the arguments against circulation were proposed only for the sake of argument; see AT II 344), he remained resistant on the subject of the movement of the heart. According to him, this could never be caused by the fact that the blood is heated in the heart because the latter continues to react to stimuli long after it is removed from the body, even in cold-blooded **animals**. In his replies, in which he refers to vivisection on rabbits and eels, Descartes is forced to introduce other factors, like the specific quality of the blood of fish and similar animals. Even so, in a letter to **Mersenne** Descartes praised Plempl's objections, which according to him covered all the relevant points (AT II 192, CSMK 105). Descartes broke with Plempl when the latter published excerpts from their correspondence in his *Fundamenta seu Institutiones Medicinae* (1638), not only because it thwarted his own plans for a sequel to the *Discourse* but also because in his view Plempl had “mutilated” their exchange. Accordingly, he used **Van Beverwijck**'s invitation for a contribution to his *Epistolicae quaestiones* (1644) to publish his own part in the correspondence.

See also Beverwijck, Johan Van; *Discourse on Method*; Fromondus, Libertus; Harvey, William; Heart

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THEO VERBEEK

PLENUM

Descartes accepted the Aristotelian concept of a plenum, that is, that there are no spaces empty of matter, a view that was also popular among the Scholastics and various other early modern natural philosophers (e.g., **Hobbes**). Nevertheless, the rationale for Descartes' acceptance of the plenum is based on his unique metaphysical conception of matter. As he states in the *Principles of Philosophy* (1644), his most ambitious and important philosophical work: "That a vacuum in the philosophical sense of the term (that is, a space in which there is absolutely no substance) cannot exist is evident from the fact that the extension of space ... does not differ from the **extension of body**" (AT VIIIA 49, MM 46–47). Given Descartes' view that corporeal **substance** is only conceptually distinct from three-dimensional extension (AT VIIIA 46), it thus follows that space is a plenum and that there can be no spaces entirely empty of matter, or **vacuum**.

The traditional substance-property scheme would seem to form the basis of Descartes' unique concept of matter, moreover, since extension alone would be an accident or **attribute** without an underlying substance, which is metaphysically impossible: "From the sole fact that a body is extended in length, breadth, and depth; we rightly conclude that it is a substance: because it is entirely contradictory for that which is nothing to possess extension" (AT VIIIA 68, MM 47). While this reasoning leads to the conclusion that there can be no vacuum within the material world, if the corporeal world was finite in extent, then a nonextended vacuum outside of the world could be envisioned, as many earlier thinkers had believed. Yet Descartes rejects this possibility, arguing instead "that this world, or the universe of material substance, has no limits to its extension," since "wherever we may imagine these limits to be, we are always able, not merely to imagine other indefinitely extended spaces beyond them; but also to clearly perceive that these are as we conceive them to be, and, consequently, that they contain an indefinitely extended material substance" (AT VIIIA 52, MM 49).

The conjunction of Descartes' plenum and **metaphysics** of corporeal substance raised a number of difficulties for his natural philosophy and prompted various

unique responses. First, given his identification of corporeal substance and extension, Descartes could not employ the **explanation** given by the Scholastics for the **rarefaction and condensation** of a body (i.e., its swelling and shrinking), since that account regarded extension as a bodily “**quantity**” that could increase or decrease in size without changing the underlying material substance. Rather, Descartes offers an atomist-inspired hypothesis that explains rarefaction and condensation by means of the existence of bodily pores or channels that can swell a body’s size via the accumulation of smaller particles (AT VIIIa 43–44, MM 41–42). Another concern, which Descartes shares with earlier plenum theorists, is how the **motion** of bodies is possible given that there are no empty spaces. After explaining that “all places are full of bodies,” he reasons that

it follows that no body can move except in a complete circle of matter or ring of bodies which all move at the same time; in such a way that it drives another body out of the place which it enters, and that other takes the place of still another, and so on until the last, which enters the place left by the first one at the moment at which the first one leaves it. (AT VIIIa 58, MM 55–56)

Nevertheless, this solution runs afoul of other Cartesian hypotheses, in particular, the **definition** of body and the collision rules. Since Descartes holds that by “one body, or one part of matter, I here understand everything which is simultaneously transported” (AT VIIIa 53–54, MM 51), a circle of bodies that moves simultaneously should constitute a single body, contra Descartes’ explanation (see **individuation**). Likewise, there would appear to be no conditions under which the Cartesian collision rules apply, since these rules only involve the impact of bodies that move in a straight line (AT VIIIa 68–70), and neither impact nor rectilinear motion is possible if all motion is in a circle. Finally, since there can be no **vacuum**, Descartes was led to the somewhat problematic theological conclusion that if **God** removed the matter from within a vessel, then the sides of the vessel “must necessarily touch each other,” and so God cannot create a vacuum (AT VIIIa 50, MM 48).

See Body, Extension, Individuation, Law of Nature, Motion, Rarefaction and Condensation, Vacuum

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EDWARD SLOWIK

POISSON, NICOLAS-JOSEPH (1637–1710)

Born in 1637 in Paris, Nicolas-Joseph Poisson was an **Oratorian** priest who, like others in the Congregation of the Oratory, championed Cartesian **philosophy**. In 1668 he published a French translation of Descartes' *Compendium of Music*, together with his translation of and commentary upon a letter from Descartes to **Constantijn Huygens** that was given the title *Traité des mécaniques*. Poisson assisted **Baillet** in gathering information for his biography of Descartes and wrote a commentary on the *Discourse on Method* (1670). He corresponded with **Clerselier** and **Desgabets**, arguing with them over the Cartesian account of **transubstantiation**, which Poisson concluded was not compatible with the Catholic faith. As **Cartesianism** continued to generate controversy, Poisson was ordered by his superiors in the Oratory to abandon his plan to write commentaries on all of Descartes' works. He died in Lyon in 1710.

See also Baillet, Adrien; Clerselier, Claude; Desgabets, Robert; *Discourse on Method*; Huygens, Constantijn; Oratorian; Transubstantiation

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FRED ABLONDI

POLLLOT, ALPHONSE (CA. 1602–1668)

Pollot (Polotti, Palotti) was born at Dronero (Piedmont), the son of a Protestant family. After the death of his father, his mother moved to Geneva, and Alphonse and

his brother were sent to the Low Countries to serve in the Dutch army. Although during the siege of 's-Hertogenbosch (Bois-le-Duc) in 1629 he lost his right arm, he continued his military career until 1642, when he became attached to the court of the stadholder, Frederick-Henry of Orange, and, after the latter's death, to that of his widow, Princess Amalia. About 1650, he returned to Geneva, where he died in 1668. Pollot wrote to Descartes briefly after the publication of the *Discourse on Method* (1637). Although Descartes did not reply, a personal meeting must have followed, mediated possibly by **Henricus Reneri**. Descartes was impressed by Pollot's mathematical expertise, believing that he was one of the few to understand his *Geometry* (AT I 518). Later Pollot served as an intermediary between Descartes and **Princess Elisabeth** and advised Descartes during his conflict with **Voetius**. Pollot is seen as the main author of a series of objections to Descartes' *Discourse*—written in the form of a letter by a certain “S.P.” (AT I 512–17; for Descartes' reply see AT II 34–46, CSMK 96–102). Planned by Descartes as a sequel to the *Discourse* and coming after the objections of others, they were probably prearranged so as to cover the entire spectrum of questions discussed in the *Discourse*. Thus, there are questions, for example, on the *cogito* (e.g., why not “I breath, therefore I am”?), the **animal** soul, and **subtle matter**. Although it is likely that they were authored by Pollot, others, like Reneri and possibly even **Constantijn Huygens**, may have contributed as well. Pollot's unpublished copy of the *Treatise on Man* was one of the sources of the first edition of that work in 1662.

See also *Discourse on Method*; *Geometry*; Elisabeth, Princess of Bohemia; Reneri, Henricus; Voetius, Gysbertus

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THEO VERBEEK

PREJUDICE

Prejudices (Latin *praejudicia*, French *préjugés*; usually translated as “preconceived opinions” in CSM) are opinions that we accept not because we have clearly perceived that they are true but as a result of earlier **judgments** we have made (AT IXA 204, CSM II 270). The Latin term *praejudicia* literally means “prejudgments.” Descartes explains that the proposition “whatever thinks, exists” can be described

as a prejudice when we put it forward without attention and believe it to be true only because we remember having previously judged it to be so. If we examine the proposition and believe it to be true because it is evident to the understanding, then it is not a prejudice (AT IXA 205, CSM II 271). So a prejudice is an opinion that is accepted without sufficient reason, but not everything accepted without sufficient reason is a prejudice. The first time I assent to something I do not clearly understand, the opinion I form is not a prejudice, but it becomes one if I continue to affirm it simply because I did so in the past.

We are able to form the kind of judgments that give rise to prejudices because we can choose to affirm what we do not clearly perceive (AT VIIIA 18, CSM I 204–5). The natural light of **reason** tells us that we should not do this (AT VIIIA 21, CSM I 207; cf. AT VII 60, CSM II 41), but Descartes identifies several ways in which it can occur. In childhood, we do not have full use of our reason and cannot examine the basis for our judgments (AT VIIIA 5, CSM I 193). In adulthood, we may forget that we should not judge where we do not clearly perceive (AT VII 62, CSM II 43). Through carelessness and inattention, we may not notice the obscurity or confusion in our **perception** (AT VIIIA 21, CSM I 206). Through rashness and an eagerness to find the **truth**, we may assent to something that we do not fully comprehend (AT VIIIA 21, CSM I 206–7).

These ill-considered judgments give rise to prejudices if we continue to affirm them. Presumably inattention, rashness, and lack of reason can play a role here too. And we may be unwilling to change our **minds** through laziness or stubbornness (AT VII 377, CSM II 259). But the mechanisms for the maintenance of beliefs most often mentioned by Descartes are **memory** (AT VIIIA 36, CSM I 219–20) and **habit** (AT VII 35, CSM II 25). Both contribute to the two sources of prejudice with which he is most concerned: childhood and traditional philosophy. Descartes describes childhood prejudices as “the first and main cause of all our errors” (AT VIIIA 35–36, CSM I 218–19). Childhood prejudices reflect the infant mind’s immersion in the **body** and preoccupation with sensory perceptions (AT VIIIA 22, 35; CSM I 208, 218). As children we develop the habit of treating sensory perceptions as reliable guides to the nature of material things (AT VII 83, CSM II 57). We form what Descartes regards as erroneous beliefs about the physical world, such as the belief that some spaces contain no body (AT VIIIA 49–50, CSM I 230). Since we never exercise our **intellects** without picturing something in the **imagination**, we come to conceive everything as corporeal (AT VII 441, CSM II 297). This prevents us from forming clear **ideas** of the **soul** and **God**, immaterial things that cannot be grasped through images (AT VI 37, CSM I 129). These childhood prejudices also give rise to epistemic errors. Forgetting that they were adopted without examination, we regard our prejudices as “known by the senses or implanted by nature” (AT VIIIA 36, CSM I 219); through “a habit of believing,” we think that we perceive things clearly when we do not (AT VII 35, CSM II 25). Thus prejudices of the senses usurp the place of

the innate ideas that would enable us to clearly perceive the nature of the soul, God, and material things. Since “there is nothing whose true nature we perceive through the senses alone,” most people have nothing but confused perceptions throughout their lives, though they take them for distinct ones (AT VIIIA 37, CSM I 220).

The prejudices formed in childhood may be overlaid and reinforced by those derived from philosophical teaching (AT IXB 12, CSM I 185). The Scholastic doctrine that there is nothing in the intellect that was not first in the senses, for example, results from our infant reliance on the senses (AT VII 75, CSM II, 52). The Scholastic ideas of **substantial forms** and **real qualities** are constructed by mingling the innate ideas of body and soul, a confusion that begins in childhood (AT III 420, CSMK 188). Thus the primary seeds of truth naturally implanted in the human mind are stifled through our constantly reading and hearing all sorts of errors (AT X 376, CSM I 18).

Descartes’ views about the nature and extent of human prejudices play a central role in his philosophical system. He has a highly optimistic view of what the human mind can achieve in the search for truth, reflecting his nativist belief that a perfect and benign creator has equipped our minds to understand him and his creation. God has given us an intellect capable of clear and distinct perception, complete with innate ideas of **substance**, **thought**, **extension**, and the divine nature. But if this is so, why are we largely unaware of it? The answer lies in the prejudices of childhood and the influence of traditional philosophy, which overwhelm us (AT VII 69, CSM II 47) and obscure and confuse our perceptions (AT VII 518, CSM II 352–53). One might wonder how a benevolent God could have made us subject to such systematic error (see **error**, **theodicies of**). But God can be seen to have worked for the best if we consider that as helpless infants our priority is bodily survival, and we make judgments about physical things insofar as they contribute to our preservation (AT VII 441, CSM II 297). Since sensory perceptions are given to us by God to indicate what is beneficial or harmful for our preservation (AT VII 83, CSM II 57), it is understandable that they should guide our infant judgments. And since God is benevolent, he has given us the means to correct any falsity in our opinions (AT VII 80, CSM II 55–56). It is our responsibility to remove our prejudices and correct our errors when we reach adulthood.

Prejudices are formed through inattention, rashness, and preoccupation with the senses. To correct them, we must examine our beliefs carefully while withdrawing the mind from the senses. The **method of doubt** is particularly important here: the only way to free ourselves from prejudices is to “make the effort, once in the course of our life, to doubt everything which we find to contain even the smallest suspicion of uncertainty” (AT VIIIA 5, CSM I 193). Prejudices can be called into doubt because they are ill-grounded, but long-standing habits of thought are not easily broken (AT VII 22, CSM II 15). “Only those who really concentrate and meditate and withdraw their minds from corporeal things” will clearly grasp the

primary notions of metaphysics innate in the mind (AT VII 157, CSM II 111). One of Descartes' principal philosophical aims is to show us how to achieve this.

See also Analysis versus Synthesis; Error, Theodicies of; Habit; Intellect; Judgment; Method; Reason; Sensation; Truth

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SARAH PATTERSON

PRIMITIVE NOTION

Primitive notions are most familiar from the celebrated letters Descartes exchanged with **Princess Elisabeth of Bohemia** on the topic of mind-body interaction, but they figure prominently in many of Descartes' writings. Descartes sometimes introduces them as notions *or* **ideas**, making it clear that either word is acceptable (e.g., AT III 691, CSMK 226; cf. AT VII 440, CSM II 296 and AT VIIIB 358, CSM I 303). In the early *Rules for the Direction of the Mind*, he refers to "primary seeds of **truth** [*prima veritatum semina*] naturally implanted in human **minds**" (AT X 376, CSM I 18; cf. *The World* AT XI 47, CSM 2 97). The "seeds of truth which are naturally in our souls" return in the *Discourse on Method* (1637) as "primary truths" (AT VI 64, 76; CSM I 144, 150). In the first of the famous pair of letters to Elisabeth, Descartes crucially relies on primitive notions (*notions primitives*), also called "simple notions" (*notions simples*), that the soul "possesses by nature" as "ready-made" (AT III 666–67, CSMK 219). And in the letter to **Voetius** written at the same time as the exchange with Elisabeth, we again have "notions" that are "innate" in virtue of being "implanted" in the soul (AT VIIIB 166, CSM I 222). In the *Principles of Philosophy*, the principles referred to in the title are characterized in much the same way. They can be clearly and distinctly perceived or intuited, and they enable the **deduction** of "all other things" (AT IXB 9–11, CSM I 183–84). This treatment of principles is not surprising given that the words translated as "primitive," "primary," and "principle" can be synonymous in both Latin and French. Finally, in August 1649, less than half a year before his death, Descartes makes use of primitive notions in a letter to **More** (AT V 402–3, CSMK 381).

Despite these continuities, Descartes does not settle on an exact characterization of primitive notions, nor does he supply a detailed and absolutely complete inventory. It is abundantly clear that primary notions are innate, but this affords little help because Descartes' treatment of innate ideas is notoriously difficult. An important source of Descartes' apparent vagueness about primitive notions is that he wants to distinguish notions or ideas (and, in the *Rules*, **simple natures**) that are strictly primitive from those that are basic relative to more derived notions but are still derived from the strictly primitive. Therefore, he sometimes seems to focus on a very few maximally primitive notions. Other times, he is prepared to allow that notions that are obtained from the maximally primitive by deduction or by combination (see Beck 1952, ch. 5, and Landy 2011) can be classified as primitive. So in the *Rules* the most primitive items to be intuited are the

very few pure and simple natures which we can intuit straight off and *per se* (independently of any others) either in our sensory experience or by means of a light innate within us. We should, as I said, attend carefully to the simple natures which can be intuited in this way, for these are the ones which in each series we term simple in the highest degree. (AT X 383, CSM I 22)

In this early work, Descartes has not yet arrived at his later, settled use of the terms “notion” and “idea.” Nonetheless, it is clear from their connection with intuition and innateness that the simple natures of the *Rules* are direct ancestors of primitive notions, unless they are entirely the same things. Here, the degree of simplicity is relative except for these few purely simple natures (or notions). Similarly, in the passage from the *Principles* quoted earlier, Descartes specifies that he begins with notions of **thought**, **God**, and **extension**, and from them he then proceeds to deduce the rest. So if the laws of **motion** are taken to be “principles” and hence primary or primitive (e.g., at AT VIIIB 80, CSM I 248), it is in a less strict sense. A list of subsidiary laws and notions that are “primitive” only relative to very complex notions would be extremely difficult, if not impossible, to make.

Another reason for some vagueness in cataloging the primitive notions is that Descartes sometimes includes **common notions** (e.g., AT X 419–20, CSM I 45) or axioms (e.g., AT VIIIB 23–24, CSM I 209) or generic **attributes** (AT III 665, CSMK 218) among the primitive notions. These categories contribute to vagueness because Descartes regards them as innumerable (AT VIIIB 24, CSM I 209) and because they are, in the case of common notions or axioms, usually presented as only relatively primitive or simple. That is shown by their being deducible from still simpler notions (AT I 476, CSMK 77; AT VII 164, CSM II 116).

Despite their ubiquity in Descartes' **philosophy**, scholars have focused their attention on the letters to Elisabeth because it is there that Descartes explicitly

makes use of a primitive notion of the union of mind and **body** that constitutes the **human being**. In her letter of May 6, 1643, Elisabeth asked Descartes to explain how an unextended mind could determine a body to move as happens in voluntary motions (AT III 661).

In response, Descartes admits that he did not explain the **metaphysics** and epistemology of the union in the *Meditations* because it was not required in that context (AT III 664–65, CSMK 218; cf. AT IXA 213, CSM II 275). Rising to Elisabeth's query, he identifies an innate primitive notion of the union of mind and body. The power of the mind to move the body (and the body to affect the mind) must, he says, be understood through this primitive notion and not the primitive notions of the mind and of extension, which are already familiar from his earlier writings:

I observe next that all human **knowledge** consists solely in clearly distinguishing these notions and attaching each of them only to the things to which it pertains. For if we try to solve a problem by means of a notion that does not pertain to it, we cannot help going wrong. (AT III 665–66, CSMK 218)

Readers of Descartes' previous works might naturally assume that to conceive of the union would require clear and distinct **perceptions** of both mind and body and, crucially, an understanding of how those two clearly and distinctly perceived **substances** interact. This is quite impossible as Descartes fully realized. He makes this explicit in his second letter to Elisabeth of June 28, 1643:

It does not seem to me that the human mind is capable of forming a very distinct conception of both the distinction between the soul and the body and their union; for to do this it is necessary to conceive them as a single thing and at the same time to conceive them as two things; and this is absurd. (AT III 693, CSMK 227)

The upshot, therefore, is that the primitive notion of union and no other makes the union conceivable or intelligible as a single thing [*seule chose*]. It also makes intelligible that "we experience within ourselves certain other things which must not be referred either to the mind alone or to the body alone. These arise ... from the close and intimate union of the mind with the body" (AT VIIIB 23, CSM I 209). Here, in *Principles* I.48 Descartes goes on to list appetites, emotions, and **sensations** as the things that must be "referred to" the union or conceived through the primitive notion of the union.

It is one thing to assert that there is a primitive notion of the union; it is another to convince someone that they have it. Descartes works hard, in the *Meditations*, for example, to bring his readers to conceive of mind, body, and their **real distinction**

in the right way. In the letters to Elisabeth, he employs two strategies for accessing the primitive notion of union. The first is a refurbishing of an **explanation** from the Sixth Replies of how the simple notion of mind can become confused with the simple notion of body. There he discusses a confused physical theory of **gravity** or heaviness that makes it a real quality of bodies:

Moreover, I saw that the gravity, while remaining coextensive with the heavy body, could exercise all its force in any one part of the body; for if the body were hung from a rope attached to any part of it, it would still pull the rope down with all its **force**, just as if all the gravity existed in the part actually touching the rope instead of being scattered through the remaining parts. This is exactly the way in which I now understand the mind to be coextensive with the body – the whole mind in any one of its parts. (AT VII 442, CSM II 298)

The explicit point in the Sixth Replies is that this faulty theory of gravity is based on failing to make proper use of the distinct primitive notions of mind and body. Descartes' own theory makes no use of the primitive notion of mind. Writing to Elisabeth, he adds that in the old theory of gravity, "we have no difficulty in conceiving how it moves this body or how it is joined to it ... we find from our own inner experience, that we possess a notion that is ready-made for forming the conception in question" (AT III 667, CSMK 219). Elisabeth replies, in effect, that it is easier to believe that Descartes' own **physics** shows it is impossible for an unextended thing to move the body than it is to believe it possible on the basis of a false physics (AT III 684). But this reply is based on a misunderstanding of Descartes' use of the example in his letter. He is not suggesting that the bad theory of gravity somehow explains the mind's power to move the body. The point is that the bad theory has seemed intelligible to people because they (mis-) used the primitive notion of the union to conceive it. In other words, the seeming intelligibility of the bad theory is explained by the innate conceivability of the union. It can even be argued that Descartes should have maintained that the primitive notion of the union is required to conceive of the action of bodies on other bodies. Because the motion of bodies depends on God's having created extension with some quantity of motion, the physics of collisions cannot be conceived through the primitive notion of extension alone (see Garber 2000).

Elisabeth raises a sharper objection in her letter of July 1, 1643. The faulty account of gravity comes from using perceptions that are not clear and distinct but are instead very confused. So she reminds Descartes that according to his Fourth Meditation rule for avoiding metaphysical error, we should refrain from judging that the soul cannot move the body by being somehow extended (AT IV 1). This objection also applies to Descartes' second strategy for helping his readers to access the primitive notion of the union:

Metaphysical thoughts, which exercise the pure **intellect**, help to familiarize us with the notion of the soul; and the study of mathematics, which exercises mainly the imagination in the consideration of shapes and motions, accustoms us to form very distinct notions of body. But it is in the ordinary course of life and conversation, and abstention from meditation and from the study of the things that exercise the imagination, that teaches us how to conceive the union of the soul and the body. (AT III 692, CSMK 227)

This is naturally read as suggesting that one must be immersed in the senses, and therefore avoid clear and distinct perception in order to clearly (but not distinctly) perceive the primitive notion of the union. But if this primitive notion is inherently confused, it seems that it cannot provide any assistance in showing how it is possible that an unextended soul could move the body, or that the soul and the body are substantially united. If Descartes wrote a reply to Elisabeth's letter of July 1, it has been lost. We do know that he regarded what he wrote in the extant letters as satisfactory because he repeated it in subsequent writings. The strategy of regarding gravity as an accident of bodies and the accessibility of the primitive notion of the union by means of everyday experience both appear as late as the July 29, 1648, letter for **Arnauld** (AT V 222–23, CSM 357–58).

It is possible, however, that Descartes did not mean to rely finally on an appeal to an ineluctably confused primitive notion in his theory of the human being. All the other primitive notions, innate ideas, and the like listed by Descartes can be clearly and distinctly perceived; indeed, that is their principal role in his theory of knowledge. It would be odd for him to have included a primitive notion of union while omitting this characteristic and central feature. And there are a number of texts that seem to suggest that the primitive notion of union is not distinguished by its being inherently confused, so this speculation is worth pursuing.

After first listing some primitive notions for Elisabeth, Descartes wrote in a passage already quoted that, "all human knowledge [*science*] consists in distinguishing well [*bien*, CSMK has "clearly"] these notions and attributing [*attribuer*, CSMK has "attaching"] each of them only to the things to which it pertains" (AT III 665–66, CSMK 218). It is noteworthy that Descartes uses the French word, *science*, or the Latin *scientia* to refer to clearly and distinctly perceived principles or to knowledge derived from such items. And in this context, the primitive notion of union seems to be included. In the letter to Arnauld mentioned earlier, Descartes refers to what is shown by "everyday experience," as he does to Elisabeth, but he follows this by saying that it is "self-evident" (*per se notis*; AT V 222, CSMK 358) that the soul moves the body. In general, Descartes reserves the term "self-evident" for clearly and distinctly perceived items. He continues by saying that the self-evidence is obscured only by trying to explain it using the primitive notions of mind and of extension.

If the primitive notion of union is on an epistemic par with the primitive notions of mind and extension, then why would Descartes repeatedly write that the latter two are known by the intellect but that the former is known from everyday life and by refraining from metaphysical meditation? In the second letter to Elisabeth, Descartes sets out to explain “the difference between these three kinds of notion and the operations of the soul by which we acquire them” (AT III 691, CSMK 226). In each of the three cases, acquiring the knowledge requires its own “*operation of the soul*.” The primitive notions are innate to the soul, so the soul must find them by conducting operations within itself.

To acquire the primitive notion of the soul, the soul must operate on the idea of a **mode** (viz., an occurrent thought) until the notion is clear and distinct. This is done, for example, in the Second Meditation by performing the *cogito*. That enables the mind to prescind from the primitive notion of extension. To acquire the primitive notion of extension, the soul must operate on the idea of a mode that pertains to body – a distinctly imagined shape, for example. When this is done in the Fifth Meditation, sensory ideas of colors and the like are excluded. In each of these cases, the “operation” in question is the removal of confusion from the idea or notion so that what remains is clear and distinct. Finally, acquiring the primitive notion of the union requires the soul’s operating on something that pertains to the union. That would be a sensation, emotion, or something that is “felt” in everyday life. But, again, it is the *soul* or intellect that must operate on some confused idea taken from everyday experience so that the primitive notion of union is acquired. If we grant that there is such a primitive notion, it does not seem unreasonable that it would be acquired by the soul’s making it clear and distinct by removing confusion about what sensations and the like do in fact pertain to, namely the union (see Nelson 2008, 2013). In other words, the sense in which the union is “known only obscurely by the intellect alone” is that the union is not intelligible until the intellect reflects on the nature of sensation (AT III 691–92, CSMK 227).

If the primitive notion of union is thus on a par with the other two, then Descartes’ position would be quite clear. To ask *how* mind and body interact is to improperly invoke that corresponding pair of primitive notions to do the job of the third. This position might seem unsatisfying and invite the objection that it is no more than a brute appeal to a supposed clear and distinct notion of union. But the dissatisfaction has no more ground and the objection has no more force than the parallel consideration that Descartes ultimately explains body-body interaction and mental causation by brutally appealing to their primitive notions. The objection collapses into the familiar, general worry about Descartes’ reliance on a particular set of perceptions that are clear and distinct in his special sense.

The advantages that Descartes might have gained by positing a clearly and distinctly perceivable primitive notion of union are partially counterbalanced by the

disadvantage of intensifying the much-discussed worry that Descartes' doctrines are inconsistent (see Alanen 2003, Garber 2000, and Rozemond 1998). The basic problem is that mind and body are at once really distinct while being joined in a union, or *ens per se*. It is intensified if the starkness of the opposition is clear and distinct rather than muted in an intrinsically confused primitive notion of union. On this point, Descartes could adduce his dictum that we must not **doubt** things we do clearly and distinctly perceive on grounds that we do not clearly and distinctly perceive them. So we should not doubt either real distinction or union because we do not understand how God could unify really distinct things (AT VII 436, CSM II 294). In the *Principles*, Descartes invokes the dictum to address both the apparent inconsistency of divine providence and **free will** (AT VIII B 20, CSM I 206) and, again, our understanding of the actual, indefinite division of extension (AT VIII B 60, CSM I 239). For many readers, Descartes' cheerful acceptance of apparently conflicting clear and distinct perceptions is one of the most perplexing aspects of his philosophy.

See also Clarity and Distinctness; Common Notion; Elisabeth, Princess of Bohemia; Gravity; Human Being; Idea; Intellect; Knowledge; Sensation; Simple Nature; Truth

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PRINCIPLES OF PHILOSOPHY

Principia Philosophiae constitutes the most comprehensive book that Descartes ever wrote. He calls it his “**philosophy**.” The text combines an exposition of Cartesian **metaphysics** with an exposition of his **physics**, itself unparalleled in the rest of Descartes’ corpus. Without a doubt, the scope of the work explains the interest that will be shown in it by other thinkers of the early modern period, such as **Spinoza** and **Leibniz**, who will take the first two parts of this text as a basis, first, to give a systematic account of Descartes’ thought (Spinoza’s *Principles of Descartes’ Philosophy*) and, second, to criticize its fundamental principles (Leibniz’s *Critical Remarks on Descartes’ Principles*). For all the stress placed by recent scholarship on the *Meditations*, to many of his contemporaries Descartes was primarily the author of the *Principles*.

The genesis of this text clarifies the stakes. In November 1640, Descartes announces to Mersenne his intention to prepare a “complete textbook of my philosophy” (AT III 233, CSMK 157), which he conceives of as a competitor to the philosophy of the schools (i.e., the philosophy, nurtured by Aristotle, taught in **Jesuit** schools). At that time, Descartes is still preparing to publish the *Meditations*: he has just completed the First Set of Replies to Objections (see *Objection and Replies*). But, in July 1640, the Jesuit **Pierre Bourdin** publicly criticizes the *Dioptrics*, which acutely irritates Descartes: “I am going to become engaged in a war with the Jesuits. Their mathematician in Paris has publicly attacked my *Optics* in his theses, and I have written to his superior with a view to involving the whole Society in this quarrel” (AT III 103, CSMK 151). This is the origin of the work that was to become the *Principles*.

Fortunately, a relative truce is established as a result of Bourdin’s commitment to formulate objections to the *Meditations*. Descartes receives these objections in January 1642. They concern principally the **method of doubt**, the real distinction between **mind** and **body**, and the **existence of God**. He published this Seventh Set of Objections and Replies in the second edition of the *Meditations* (May 1642), accompanied by the Letter to **Father Dinet** (Descartes’ former teacher and Bourdin’s superior in the Jesuit order), in which he publicly announced his determination to publish his “philosophy.” The Latin *Principles* was published in July 1644. A French translation by the **Abbe Picot**, accompanied by Descartes’ important letter-preface, was published in June 1647.

Descartes has two primary aims in this work: first, to eradicate the Scholastic concept of **substance** and the related doctrine of substantial forms and replace them with the Cartesian doctrine of mind-body distinctness (see **form, substantial**). Along the way he hoped to defend the method that produced these results and present his system in way that would be suitable for teaching. This aim is all the more urgent given that in the weeks before receiving the Seventh Objections, these themes are the subject of another attack in the Netherlands, where the “quarrel of Utrecht” broke out (December 1641) (see **Regius, Henricus** and **Voetius, Gysbertus**).

Second, Descartes aims to respond to criticism of the *Dioptrics* that formed the project of a “whole course of philosophy.” This project was to go beyond the scope of his first philosophy alone. Descartes complains in the Letter to Dinet that he has not seen this work or his *Meteors* among the manuals of the Jesuit colleges (AT VII 573, CSMK II 386). Published in 1637, these two scientific essays take the place of a project explaining “all the phenomena of nature, that is to say the whole of Physics” (AT I 70, CSMK 7), which was to be comprised of *The World* and the *Treatise on Man*. After the condemnation of **Galileo** in 1633, Descartes had given up this project and opted for “some matters which, without being subject to many controversies,” did not oblige him to reveal more of his principles than he wished to do (AT VI 75). But Bourdin’s attacks lead Descartes to return to the project from 1629: “Perhaps these Scholastic wars will result in my *World* being brought into the world ... I shall call it *Summa philosophiae* to make it more welcome to the Scholastics” (AT III 523, CSMK 209–10).

The *Principles* consists of four books: the first is devoted to the principles of **knowledge** and the last three to Cartesian physics. Without proposing any major doctrinal innovation, the first part nonetheless differs from the *Meditations* in its order of arguments. It has long been held that, following Gueroult, one could explain these differences by appealing to two general considerations. First, at the end of the Second Replies, Descartes draws a distinction between two methods of demonstration, analysis and synthesis (see **analysis versus synthesis**). He claims there to have written the *Meditations* in the analytic method alone (AT VII 156, CSMK II 111). Second, in the *Conversation with Burman*, Descartes is reported to have said that he employed the synthetic method in the *Principles*. Recent commentators (Beyssade 1996, Cohen and Garber 2001) have argued that we should take this last pronouncement with a grain of salt. On their view, the *Principles* is only quasi synthetic, and the synthetic presentation is limited to such items as the proofs for the existence of God, which adopt the order of the **Geometrical Exposition**.

When Descartes refers to the relation between the *Meditations* and the future *Principles* in his **correspondence** (AT III 276, CSMK 167), he stresses a difference in style or form, which appears to refer to the latter’s abridged character and to its division into short sections, which he says are designed to make it easy to teach (AT III 233, CSMK 156–57). But this does not settle the matter for now we are confronted with two texts that point in opposite directions as to which method of demonstration is most suitable for teaching (AT VII 156, CSMK 167; AT V 153, CSMK 337–38). Moreover, some differences in the order of arguments in the two works make it appear that there is more than a change in the method of demonstration: for example, in the *Principles* Descartes directly infers the real distinction between mind and body from the *cogito* (AT VIIIA 7, CSM I 195), whereas he had said in the *Meditations*, in response to an objection to the *Discourse on Method*, that this demonstration presupposes the veracity of God and an examination of the **essence** of bodies. By returning in the *Principles* to the order of argument of the

Discourse, Descartes presupposes that the objection has been refuted. This change marks a deepening of the doctrine and not simply a restructuring of the argument.

With respect to Descartes' physics, what is distinctive about the *Principles* is the effort to set out for the first time a Cartesian physics following "such an order that the proof of what comes later depends solely on what has come earlier" (AT VII 577, CSM II 389), different from the order that he adopted in *The World*. This difference is related to the **explanation** of the concept of "principle" that Descartes will give in the letter-preface (AT IXB 2, CSM I 179–80). Cartesian physics is here explained on the basis of his principles. This means in particular that the exclusion of substantial forms is metaphysically grounded: Descartes intends not only to give an explanation of physical phenomena that does not use substantial forms (as he did in *The World*) but to deduce this exclusion from the substantial distinction of **thought** and **extension**. Descartes admits, however, two different types of principles in his physics. Those he mentions in the second part (the principles of material things) are deduced from **metaphysics**. However, the explanation of the visible world in part III and of terrestrial phenomena in part IV introduces principles that are validated by their ability to account for the phenomena.

The French version of the book is characterized by important differences, such as those concerning the laws of the collision, which bear witness to the weakness of Picot's translation (II.43–45) but also to the fact that Descartes himself revises certain passages (II.46–52). The implications of each change must therefore be evaluated on a case-by-case basis.

See also Analysis versus Synthesis; Bourdin, Pierre; Dinet, Jacques; *Discourse on Method*; Form, Substantial; Geometrical Exposition; *Meditations on First Philosophy*; Metaphysics; *Objections and Replies*; Philosophy; Physics; Picot, Claude; *Treatise on Man*; *The World*

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LAURENCE RENAULT

PRIVATE THOUGHTS

Inspired perhaps by **Isaac Beeckman**'s famous *Journael* or *Tafelboekje*, Descartes kept a kind of diary in 1619 and 1620 that is mentioned as item number C in the inventory of his possessions made up in Stockholm in 1650. This *petit registre en parchemin* has not survived, but various seventeenth-century descriptions indicate that Descartes divided the notebook into separate chapters with titles such as *Parnassus*, *Olympica*, *Democritica*, *Experimenta*, and *Praeambula*. It contained miscellaneous scientific and mathematical notes and was arranged in such a way that the booklet could be read from both sides.

What is now left of these texts is known in part as the *Cogitationes privatae*, the Latin part of the title (*Pensées / Cogitationes privatae*) that Alexandre Foucher de Careil (1826–91) gave to his edition of the mathematical, scientific, and philosophical notes that he found in a copy made by **Gottfried Wilhelm Leibniz** in Paris on or around June 5, 1676. The other surviving part consists of Descartes' description of the famous dreams he had in Germany following Saint Martin's Eve in 1619. This latter text has been preserved by **Adrien Baillet** (1647–1706), who quoted it in full in his biography *La vie de Monsieur Des-Cartes* (1691).

During the short period Descartes spent with Isaac Beeckman at the end of 1618, the two friends discussed a variety of questions: the nature of **light** and free fall of bodies, as well as hydrostatic problems (see **hydrostatics**) and questions of musical theory. Some of these problems derive from the work of Simon Stevin (1548–1620) and illustrate the way in which Beeckman first inspired Descartes' interest in natural philosophy, as well as an interest in the mathematical representation of physical phenomena. Descartes, for his part, impressed Beeckman with his mathematical skills.

The mathematical passages Leibniz copied from Descartes' notes contain descriptions of the "new compasses" Descartes had devised for trisecting angles and finding mean proportionals. One of these, the so-called mesolabium for mean proportionals, inspired him to sketch various extended versions by which cubic equations could be solved. These instruments were not meant for reading off the results directly; rather they served to draw curves by which the mean proportionals or the roots themselves could be constructed. Not yet the mathematician he would later become, Descartes thus made the first steps in the direction of his future successes in linking geometrical problems to algebraic equations. The use of his compasses, which in a very graphic way showed some of the relations obtaining between lines, angles, and curves, at the same time contributed to Descartes' initial conviction of the fundamental role played by the **imagination** in intellectual understanding.

The *Private Thoughts* in fact evince a broader interest in the role of *phantasia* or *imaginatio* in the young Descartes, who argued that "Olympian matters" such as "spirit," "life," "**knowledge**," "love," and "creation" are well represented by images of "wind," "movement with the passage of time," "light," "heat," and "instantaneous activity," respectively (AT X 218, CSM I 5). Whereas such reflections may point to an interest in the young Descartes in the mnemonic techniques of the Renaissance tradition in the "Art of Memory," observations such as that poets are better equipped than philosophers to formulate "weighty **judgments**" point to an emphasis on the role of fantasy and the imagination that is a striking feature of the *Private Thoughts* more generally – and a more conspicuous feature, indeed, than the occasional parallel to later viewpoints.

A different but no less striking interest in the powers of the imagination occurs in the description of the three consecutive dreams recounted in the notebook. Whereas Sigmund Freud in 1929 declined to interpret the dreams in the absence of the dreamer, Descartes himself interpreted the first two, frightening visions as a warning against a past that might have been less innocent in the eyes of **God** than it might have seemed by human standards. In the third, agreeable dream, he saw a prevision of the future. Others have dug deeper. In 1992 John R. Cole presented a book-length study in which he used minute biographical details to support an interpretation of Descartes' dreams as symptoms of (1) the young philosopher's psychological struggle with his decision not to step into his father's footsteps as a lawyer, combined with (2) his anxiety and fury over Beeckman's refusal entirely to take seriously his overambitious plans in the realm of philosophy and science (see **dreams, Descartes' three**).

An impressive number of other studies have been devoted to Descartes' dreams, some offering alternative interpretations, others written from a more skeptical viewpoint. Whatever background there may have been to Descartes' nightly visions of being forced by strong winds, failing to greet an acquaintance, being offered a melon, and finding the line "What way of life shall I follow?" in a poem by Ausonius,

at least it seems clear from both the dreams and the context in which they took place, that Descartes experienced worries over his choice of life. If it is true that the young philosopher found new inspiration before daybreak after having woken up twice in a fit of hyperventilation, the whole event is rather consistent with the reason Descartes himself offers in the very first entry of his notebook for mounting the stage with a mask – not in order to conceal any of his true beliefs or opinions, but to hide his insecurity.

See also Beeckman, Isaac; *Compendium of Music*; Dreams, Descartes' Three; Geometry; Imagination; Mathematics

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QUALITY, REAL

In Aristotelian **Scholasticism**, we find the notion of a real quality, a quality that is a *res*, a thing in a technical sense that is more than a **mode**, or, more broadly, the notion of a real accident. Such a quality is really distinct from its subject and separable from the **substance** it inheres in by **God's** power. In Descartes' words, it has its own act of **existence** (AT III 667, CSMK 219). A prominent reason why such qualities were accepted was the view that **transubstantiation** requires the separability of qualities. In the sacrament of the Eucharist, Christ's **body** and blood are substituted for the bread and wine, but the accidents that pertain to the bread and wine remain: **Arnauld** listed "**extension, shape, color, smell, taste and other sensible qualities**" (AT VII 217, CSM II 152–53). Arnauld anticipated that Descartes' view that all qualities are modes would raise objections on account of the Eucharist; this issue contributed significantly to his works being placed on the Index in 1663. Descartes denies that the church requires the notion of a real quality; instead, he surmises that theologians who first tried to explain transubstantiation were already committed to belief in real qualities (AT VII 252–53, CSM II 175–76).

And indeed there were also philosophical motivations for regarding certain qualities as *res*. Thus, **Ockham** argued that the question whether a quality is a *res* depends on whether a change in a type of quality can be understood in terms of locomotion. If not, it is a *res*; thus, heat is a *res*, figure is not. The Scholastics disagreed about how many types of qualities count as *res* (Adams 1987, 277–85).

Interpreters often fail to distinguish real qualities from **substantial forms**, but in Scholasticism substantial forms underlie qualities, and they are incomplete substances, not accidents. Descartes also distinguishes them. His main objection is that the notion of a real quality is incoherent, because it presents entities as being qualities and substances at the same time. It does so because it presents the qualities "as having an existence distinct from that of body" and as separable (AT III 667, CSMK 219; AT VII 441, CSM II 297; AT III 67, CSMK 219; AT VII 434–35, CSM II 293; AT VII 253–54, CSM II 176). For qualities do not exist by themselves; they are all modes. Only substances exist in and of themselves, *per se*. And even God cannot separate qualities; mutual separability would imply a real distinction, and unlike the Scholastics, Descartes thinks that a real distinction only obtains between substances (see **distinction [real, modal, and rational]**). Descartes does not raise this objection against substantial forms, which he regards as substances. He does not think the notion of a substantial form is incoherent; he claims human souls are substantial forms.

As examples of real qualities Descartes cites sensible qualities as well as heaviness, the most prominent example in his writings (AT VII 254, CSM II 177) (see **quality, sensible**). His second line of criticism has nothing to do with the conception of these qualities as *res*; it really just addresses the view that **bodies** have sensible qualities as they appear to us. He claimed this view is due to sense **perception**, or the

mistaken view that explaining sense perception requires them (AT VII 434–35, CSM II 293). On the other hand, Descartes seemed to think that if one interprets sensible qualities realistically, one must accept that there are real qualities, because, like **Suárez** and others, he thought that such qualities cannot be conceived of as modes of extension, and he held that all qualities of bodies must be modes of extension.

A third line of argument is one that he uses against both substantial forms and real qualities. Both notions are confused: they are specifically confusions of the mental and the physical; we have no conception of them (AT III 506, CSMK 208–9; AT II 367, CSMK 122; AT VII 443, CSM II 298). He offers the most extensive discussion of the notion of heaviness, which he sees as both confusing the notions of quality and a substance and confusing the mental and the physical (AT VII 441–42, CSM II 297–98) (see **gravity**). Heaviness plays a special role in his thought because he held that our notion of it is really derived from an important and useful innate **idea** of the union of body and soul insofar as it explains the action of body on soul. It does so by containing the idea of **holenmerism**: the idea that the **mind** is whole in the whole body and whole in its parts (AT III 667, 694, CSMK 219, 228; AT V 222–23, CSMK 358). Finally, he thinks that both substantial forms and real qualities are useless for the purpose of **explanation** and that his own mechanistic approach is more fruitful and makes substantial forms and real qualities superfluous.

See also Body; Distinction (Real, Modal, and Rational); Form, Substantial; Gravity; Holenmerism; Mode; Scholasticism; Substance

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MARLEEN ROZEMOND

QUALITY, SENSIBLE

Descartes’ theory of sensible qualities is situated in his mathematical **physics**, which rejects Aristotle’s naïve realism, according to which bodies actually have the colors,

flavors, odors, hot, and cold we sense in them. Echoing **Galileo's** claim in *The Assayer*, that physics does not need to assume the reality of these qualities, Descartes argues that the only real properties of **body** are **extension**, **shape**, and **motion**. To make his case he denies the resemblance thesis, that the **ideas** of sensible qualities resemble the properties in bodies that **cause** them. Following Descartes, **John Locke** similarly rejects this thesis by means of the famous distinction between primary and secondary qualities of bodies.

While this much is generally agreed on, several interpretive issues concerning sensible qualities have arisen, including differing accounts of Descartes' reasons for rejecting the resemblance thesis and his basis for claiming that sensory experience is obscure and confused. Other questions concern whether Descartes eliminates sensible qualities altogether from physics, the referents of sensible-quality terms, the metaphysical status of sensible qualities, and his analysis of real physical properties. (Note that Descartes' theory of sensible qualities is not to be confused with his rejection of the Scholastic doctrine of real qualities. See Menn 1995 and **quality, real**.)

Throughout his writings, Descartes distinguishes the "sensible qualities" from the properties in bodies intelligible to the understanding. In the *Principles of Philosophy* IV.191–95, he reserves the term "quality" for the content of **sensations** produced in the **mind** by the five external senses: touch, taste, smell, hearing, and sight. Tactile qualities include hardness, heaviness, heat, and humidity; taste results in sensations of flavors; smell yields sensations of odors; from hearing arise sounds; and vision produces sensations of light and colors (AT VIIIA 318–19, CSM I 281–83). In the **wax** analysis in Second Meditation, he separates the sensible qualities from the essential properties of bodies. After stripping off the changeable features of the wax, he concludes that a clear and distinct grasp of body by the **intellect** reveals it to be "merely something extended, flexible and changeable." Thus the coolness, fragrance, and color of the wax are merely ways it appears to perceivers under certain conditions (AT VII 30–32, CSM II 20–21). In the Third Meditation, he reiterates that clear and distinct **perception** of body includes only extension and its derivatives' size, shape, position, and motion. He dismisses his sensations of "light, colors, sounds, smells, tastes, heat and cold and the other tactile qualities" as so confused and obscure that he does not know whether they are "ideas of real things or of non-things." Such ideas he labels "materially false" (AT VII 43, CSM II 30) (see **falsity, material**). And, in the Sixth Meditation, after proving that bodies exist as the causes of his sense perceptions, Descartes claims to be certain that bodies causing these sensory perceptions "possess differences corresponding to them, though perhaps not resembling them" (AT VII 81, CSM I 56). In short, he can know that bodies have real properties corresponding to his ideas of sensible qualities, even if the qualities do not resemble their **causes** in bodies.

Descartes' most common argument against the resemblance thesis adopts Galileo's claim that physics does not need to assume the real existence of sensible

qualities. In *The World*, he says that not only the four Aristotelian elements hot, cold, wet, and dry but all other qualities “can be explained without the need to suppose anything in their matter other than the motion, size, shape, and arrangement of its parts” (AT XI 26, CSM I 89). He makes similar statements in the *Dioptrics* (AT VI 85, CSM I 153). At *Principles* IV.191ff. he explains how the nerves in the body transmit to the brain motions produced by contact with external bodies, resulting in sensations in the mind. At IV.197, he concludes that “the **nature** of our mind is such that the mere occurrence of certain motions in the body can stimulate it to have all manner of thoughts which have no likeness to the movements in question. This is especially true of the confused **thoughts** we call sensations or feelings” (AT VIIIA 320, CSM I 284). The *Treatise on Man* contains a more extended account of this theory. This “Ockham’s razor” attack on the resemblance thesis, that the intelligible properties extension, shape, and motion can account for all physical phenomena, establishes only that physics does not need to postulate real sensible qualities in bodies.

Given that weak conclusion, commentators have tried to locate a stronger argument that sensible qualities cannot be real properties of bodies. One such argument occurs in the *Rules*, where Descartes rejects the resemblance thesis because sensible qualities are not subject to the simplest procedures involved in mathematical measurement (Buroker 1991). In Rules 12–14, he argues that all real physical magnitudes must, like extension, be measurable by ratio scales: they must have an absolute zero or point of origin, they must be additive, and measuring procedures must determine the equality of ratios (Buroker 1991, 599–604). Because the intensity of sensible qualities does not satisfy these conditions, they cannot be real physical properties. Another approach considers claims in his major texts that attributing sensible qualities to bodies is unintelligible. An “essentialist” version maintains that because sensible qualities are not implications (e.g., as limitations) of the attribute of extension, they cannot be real properties of bodies (see Des Chene 1996, Downing 2011). Needless to say, several other defenses have also been identified (see Garber 1992).

A second epistemological issue concerns Descartes’ basis for maintaining that sensory ideas are obscure and confused. The traditional interpretation takes obscurity and confusion to be intrinsic to sensory experience, and false **judgments** about sensible qualities to result from this inherent confusion (see Wilson 1978, Buroker 1991, Simmons 1999). Here the childhood tendency to believe sensible qualities exist in bodies is based on the phenomenological fact that sensations present bodies as, for example, colored, hot, and cold. This conforms to Descartes’ attribution of such confused experiences to the mind-body interaction. In the Sixth Meditation, he says that although such experiences lack epistemic value, they are biologically useful in informing “the mind of what is beneficial or harmful for the composite of which the mind is a part; and to this extent they are sufficiently clear and distinct” (AT VII 83, CSM II 57) (see **human being**).

Recently, an alternative view has arisen, that the original confusion is in false judgments formed from childhood, which import obscurity and confusion into sensations. Citing *Principles* I.68 and I.70–71, proponents argue that Descartes thought that ideas of sensible qualities can be clear and distinct when judged not to be real properties in bodies (see Nelson 1996, Nolan and Whipple 2006, and Nolan 2011). Here the confusion in sensory experience depends on the failure to separate the idea as a **mode** of mind from a belief about the cause of that mode. This reading emphasizes a more detailed account of the stages involved in childhood experience (Nolan 2011). It also implies that the material falsity characterizing sensations is derived from the formal falsity in judgments about those sense qualities. This issue also touches on the thorny question about the representational nature of sensations (see **representation**).

Another issue concerns whether Descartes intends to eliminate sensible qualities altogether from physics, with some commentators claiming there is a sense in which Descartes does attribute them to bodies (see Cottingham 1990 and Jolley 1990). Because the denial of the resemblance thesis logically entails that the qualities we perceive are not real physical properties, this position evidently trades on an equivocation: sometimes “red” refers to the perceived quality, at other times to its cause in bodies. Critics of the noneliminativist view emphasize that Descartes often uses the locution “the bodies we call colored” when appearing to attribute sensible qualities to bodies. When the issue is framed in terms of the referents of sensible-quality terms, a variety of interpretations has emerged: that Descartes’ use vacillates between perceived qualities and their physical causes (Wilson 1992); that they have a “hybrid” reference, namely the mental-physical complex involved in sensation (Atherton 2004, Schmaltz 1995); and, most recently, the “nominalist” view that they refer to causes of sensations in bodies and not to any content of sensations (Nolan 2011).

In any case, the metaphysical status of perceived sensible qualities themselves should be clear: if they are not modes of bodies, the only other reality they could have is as modes of mind. But there is no reason to saddle Descartes with this view, namely, that there are red and green, hot and cold minds. Although for Descartes the sensations or ideas of these qualities are modes of minds, the qualities they exhibit are not real modes of anything, mental or physical.

These metaphysical questions are sometimes conjoined with a related metaphysical debate about the correct analysis of Descartes’ physics or the properties in bodies causing these sensations. Briefly, the traditional view argues for microphysical arrangements of particles based on lists of the intelligible properties extension, shape, and motion (Garber 1992, Wilson 1992, Wolf-Devine 1993). Others favor a “dispositional” account that attributes sensory experiences to quasi-Lockean powers or dispositions in bodies, in addition to their extension, shape, and motion (see Cottingham 1990, Jolley 1990, Gaukroger 1995). This issue can be resolved only by examining the details of Descartes’ mechanistic physics.

See also Falsity, Material; Force and Determination; Mechanics; Physics; Rainbow; Representation; Sensation

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JILL BUROKER

QUANTITY

In Aristotelian philosophy, quantity – together with **substance**, quality, and relation – is one of the four principal categories. Its relation to corporeal substance was a matter of dispute. Descartes' assertion, which agrees with the Nominalists' position,

that quantity and the thing quantified differ only in reason (AT VIIIA 45, CSM I 226), was often referred to in theological condemnations of **Cartesianism**, on the grounds that it rendered **transubstantiation** unintelligible (Armogathe 1977).

Scholastic questions on quantity standardly distinguish intensive from extensive quantity. *Intensive* quantity is the quantity associated with qualities admitting of degree, such as heat. Descartes has little explicitly to say about it. *Extensive* quantity is the quantity associated with things that occupy or are located in space (temporal duration is also an extensive quantity). *Continuous* extensive quantity, or **extension**, is said to be in **essence** spatially distributed, divisible, and impenetrable (Suárez 1856, 26:99). An extended thing is said, following Ockham, to have *partes extra partes* (parts within parts), a phrase that occurs in the Fifth Objections (AT VII 337, CSM II 234) and in the **correspondence** with **More** (see, e.g., AT VII 270, CSMK 362). According to **Suárez**, quantity need not be actually extended, and so it need not actually occupy space; its essence is to be *potentially* extended (Des Chene 1996, 104). Descartes rejects that view (AT VIIIA 42, CSM I 224; AT X 447, CSM I 62).

Descartes introduces two innovations in his treatment of quantity. In the **Rules**, he enlarges the notion of *dimension* so as to include any manner in which a thing may be considered measurable (AT X 447, CSM I 62). In the **Geometry**, he redefines the multiplication of quantities so that the product of two lines, traditionally represented by area, is a line; similarly the product of three lines is again a line, not a volume (AT VI 370). That innovation allowed quartic and higher-degree powers to be treated on an equal footing with squares and cubes. In natural philosophy, on the other hand, Descartes' conception of quantity remains geometrical: the product of two quantities is represented by a rectangle, not a line. Relations of quantities are construed in terms of geometrical proportions, not symbolically (Des Chene 1996, 302).

See also Body, Divisibility, Extension, Geometry

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RAINBOW

Descartes selected the rainbow, “a wonder of nature,” to epitomize his new way to generate **knowledge** (AT VI 325, O 332). His account in the *Meteors*, combining **geometry** and **experiment** with a theoretical structure grounded on his vision of the microworld, is the only place where he brought these three areas together to produce a theory of a natural phenomenon.

Two well-defined bows are generally visible: a bright, primary one forming a colorful lower arc and, above it, a paler secondary arc. The colors run from red at the primary bow’s upper boundary to blue at its lower and are inverted in the secondary. Descartes’ was not the first to hypothesize that the bows are produced by the passage of sunlight into and out of raindrops. However, no one before Descartes had been able to explain the existence of two arcs, nor had anyone calculated their geometry or elucidated the origins and order of their colors.

To explicate the bows’ geometry, Descartes first modeled the raindrop experimentally *via* a circular glass vessel filled with water. Descartes measured the loci of sunlight reflected within the water flask, discovering that the primary bow is produced by rays reflected internally once, and the secondary bow by those reflected twice. These measurements were difficult to make and lacked geometrical precision because the **light** forms an extended patch within the flask. For this reason and to elucidate colors, Descartes turned later in his narrative to geometry and used his law of refraction to trace the paths of rays through the drop, demonstrating that two separated bows are produced at loci that tallied well with his observations: a lower primary with a maximum radius of about 59 degrees, and an upper secondary with a minimum radius of 71 degrees (see Figure 28).

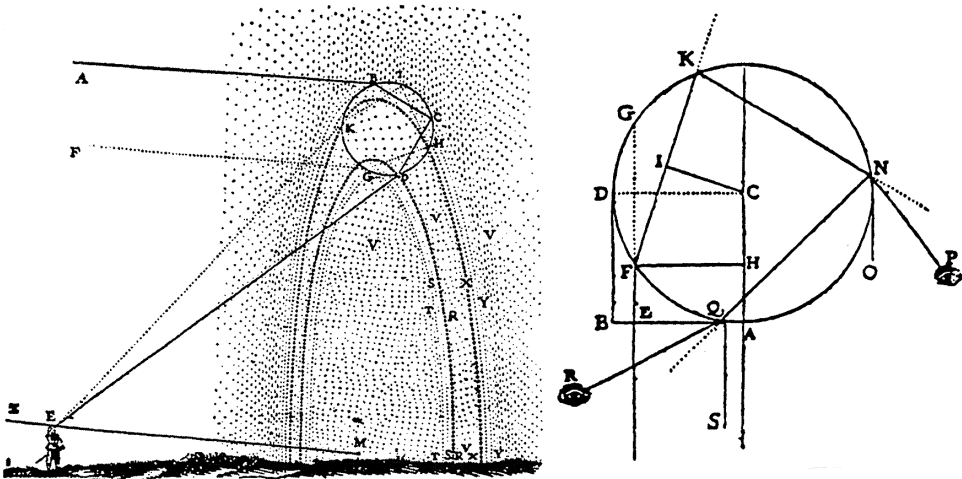


Figure 28. The geometry of the rainbow (*Meteors*, 1637).

Although Descartes remains justly famous for his geometrical ray tracing, he is equally infamous for his account of the rainbow's colors. Three decades later, **Isaac Newton** (1642–1727) explained the production of colors by refraction on the basis of unequal “refrangibility”: sunlight consists of sets of rays that come in particular kinds, with each kind having a distinct index of refraction, to which corresponds a specific spectral color. Descartes instead, in the traditional manner, referred the production of colors to the boundary between illuminated and dark regions. He buttressed his **explanation** with a detailed account grounded on his theory of the micro-world, combined with a second experimental model using a prism. From Descartes' day to the present, critics have judged that explanation to be an unsupported amalgam of perplexing theoretical claims constructed after the fact, hence nothing like Descartes' convincing calculation of the bow's geometry.

Nevertheless, Descartes' account of the rainbow's colors is perhaps the most original, and experimentally ingenious, scientific work that he ever produced. For here Descartes astutely paid productive attention to an anomalous observation that he at first had ignored. This led him to modify and then observationally and computationally to substantiate a revised theory that emerged as he thought through the implications of his microphysical model for colors in these special circumstances.

Having experimentally examined how light passes through the raindrop, Descartes turned to what he called the “principal difficulty” remaining – namely, to understand why only the light that traverses particular paths generates specific colors (AT VI 329, O 334). In a significant move, he decided to examine a different situation in which colors also arise by refraction in order to remove adventitious effects (such as the curvature of the raindrop's surface). To do so, he modeled the model: he replaced the water flask with a right-angled prism and arranged light to traverse the prism under highly restricted conditions.

Descartes held the prism so that the sun's light struck its long side (NM in Figure 29) orthogonally, producing thereby no significant refraction, and he covered the bottom with a card cut along the width of the prism to form a narrow aperture. The light passing there (DE) was refracted and thrown onto another card (HF) fixed parallel to the prism's third side, hence perpendicular to its refracting base.

Descartes aimed to use the prism to discover the geometrical factors that specify color order. There were only two parameters that he could manipulate: the angles of refraction at the aperture edges (by tilting the prism, which, however, implicated a preceding refraction), and the width of the aperture. He initially conjectured that the color sequence depended on the comparative magnitudes of the refractions at D and E. He found to his surprise that blue always appeared toward H and red at F even when the refractions at D and E exchange their relative magnitudes. He did, however, recognize that both a refraction and an appropriately sized “shadow” (i.e., a blockage of light by the cards that bound the aperture) were essential to color

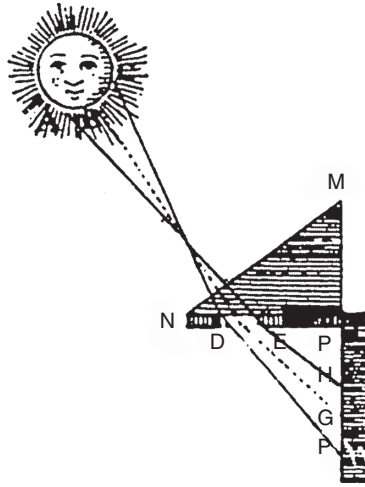


Figure 29. Descartes' prism (*Meteors*, 1637).

generation. At this point, Descartes' narrative recurs confusingly to the microworld, which, however, provided the thread that led him out of the labyrinth of possibilities.

The only free parameter that Descartes could alter, given his setup, was the aperture's width. He learned that colors appeared only when the aperture was extremely narrow; otherwise the illuminated region remained white, with tinges of red and blue at its borders. Puzzled, Descartes turned to his microworld for help, for there he had previously envisioned a mechanical feature that the **mind** could use to differentiate colors.

In Descartes' microworld, the **perception** of light arises when the particles of his second **element**, pushed mechanically by a luminous source, instantaneously transmit the push from one to the next until it reaches the retina. The resulting retinal shift is carried mechanically through the nerves, eventually reaching the **pineal gland**, where the mind interacts with these bodily actions to produce perception. Colors required a separate mechanical source that Descartes located in the spin that he supposed a light-engendering particle might have. Taking the traditional view that white light is untinted, Descartes translated this by assuming that lack of color corresponds to absence of spin.

Color depends on the relation between a particle's spin and the rate at which it would move ahead if it could (which it cannot since light is an impulse propagated instantaneously from light sources through these spherical light particles). The **analogy** Descartes had in mind was billiards. A billiard ball can be struck in such a way that it rolls without slipping. In Descartes' microworld, this corresponds to the mechanism that produces white: since the balls cannot move forward, in such a case neither could they spin. If, however, a billiard ball is struck too hard, then the connection between its forward and rolling motion is broken: the ball slips. According

SPECTRUM WITH A PENCIL-POINT
APERTURE

- 'ROSY' BLUE UPPER BORDER SHADING
TO A PURE LIGHT BLUE
- DARK RED LOWER BORDER SHADING TO
LIGHTER RED THEN YELLOW
- SMALL WHITE INTERMEDIARY SPACE

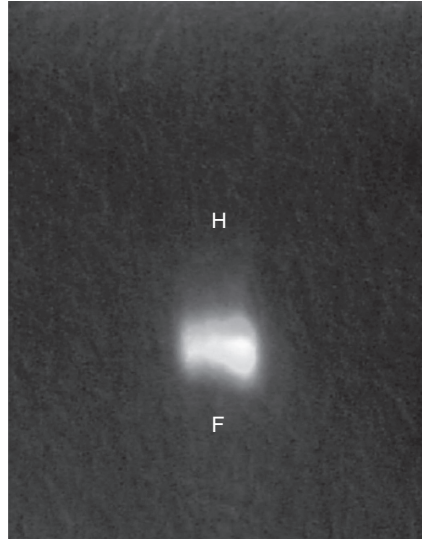


Figure 30. Spectrum with a pencil-point aperture (photograph by J. Z. Buchwald).

to Descartes, if a microworld ball spins much faster than it would in the case of white, then the perceptual effect will be red (because heated objects glow red, and heat in his microworld involves rapid motion); if much less, then blue. Intermediate colors require intermediate spins. All of this corresponds to what Descartes saw with his prism using a narrow aperture, as Figure 30, taken from a reconstruction of Descartes' apparatus, shows.

The problem was how to link this to color production by the prism (and eventually the rainbow). Descartes knew that the colors on the attached card in his prism experiment do not depend for their order on the relative magnitudes of the refractions at the edges of the beam that emerges from the bottom of the crystal. Although his narrative becomes confusing at this point it is nevertheless clear that Descartes' microworld mechanism contained enough to suggest a solution once he linked it to an experimental anomaly he had observed but initially ignored: when the aperture is narrow enough to produce a nicely colored image, the edge at H in his figure has a "rosy color" even though it is immediately preceded by blue (AT 334, O 338).

Descartes' microworld mechanism requires that to produce colors the spins of the light-producing balls in the illuminated region of his prism experiment must change across it. The spin of the balls at the beam edge that reaches F (red) must be faster than in nonslip rolling at the middle (white), and increasingly slower for the balls from beam center toward the opposite edge, at least until the far end is reached. Narrowing the aperture must, he conceived, sufficiently exacerbate the interactions among the balls not only to produce an appropriate change in spin across the illuminated region but at the far edge actually to reverse the effect on the slower, and

hence blue-inducing, spins neighboring it since the anomalous “rosy” color appears there. This clue led him to think about the strengths of the interactions among the balls.

How could this be applied to the raindrop, where no physical aperture exists? Descartes solved the conundrum by emancipating the concept of aperture from its physical embodiment. The physical aperture acts by pushing the light-inducing spheres together in order to exacerbate their spin-inducing interactions. Generalizing, one could say that an “aperture” is anything that performs the same *function*: whatever sufficiently exacerbates interactions among the balls generates colors – for example, by compressing light rays into a smaller region. Hence, areas where colors appear in the raindrop, where no physical aperture exists, must be regions where rays are concentrated. And his tabular calculations of ray geometry in the drop did indeed demonstrate that the rays are concentrated in just the right places to produce colors.

What, however, about the order of colors and their inversion between the primary and secondary bows? Here again readers have found Descartes’ account confusing, although it becomes clear once one sees that Descartes here extended a method for locating images in refraction to his observations of prismatic colors and then again generalized from that to the raindrop.

In his *Dioptrics*, Descartes failed to replace the ancient rule governing the location of images in reflection and refraction, a problem thoroughly attacked only decades later. However, the ancient “cathetus” rule did work reasonably well in many instances. The cathetus is a line dropped from the object being viewed along a perpendicular to the reflecting or refracting surface. The image is seen, according to the rule, at the intersection of that line with the ray that reaches the eye produced backward. This allowed Descartes to solve the color-order problem: he asserted that, when the eye replaces the card in his prism experiment, red (invariably at F) appears “toward” the “thicker” part MP of the prism, whereas blue appears toward the thinner part. Further, this occurs “because” the red-producing ray “comes from the part of the sun that is closest” to MP (AT VI 341, O 342). Yet the sun is vastly far away, so that “closest” would seem to make little sense until one recognizes that Descartes here deployed the cathetus rule, which is why he replaced the screen with an eye. For then the intersection in question does occur close to the prism and near MP and is moreover produced by light that comes from C on the sun. It is the *image* of C (I_F in Figure 31) that is closest to the thicker part of the prism and that generates red. The blue image (I_H) comes from the diametrically opposite edge of the sun and is closer to the thin end of the prismatic wedge.

Again generalizing from prism to raindrop, Descartes now queried whether in the latter case red occurs where the image of the bow, as seen by the observing eye, is closer in to the drop’s center (its thicker part) than the light whose image produces blue. No new computation was needed, because his existing table of refractions

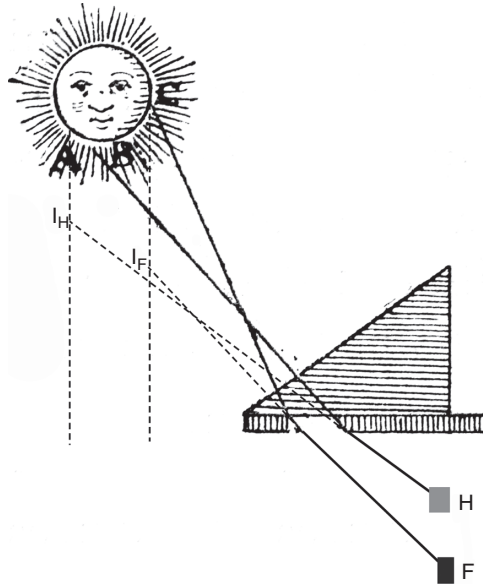


Figure 31. Descartes' prism (modified from *Meteors*, 1637).

illustrates the point when combined with a straightedge and compass: images so constructed conform well with the generalized prismatic claim.

In his accounts of both the production and the order of colors, Descartes redeployed a discovery made with the prism to the raindrop. In doing so, he could not merely explain, he could actually *predict* the properties of that “wonder of nature,” the rainbow. The path that led him to his functional generalization of the aperture was stimulated by an anomaly to which he was alert, one that led through his micro-world to a successful result. It was one of the first instances in the early modern period of a careful interplay between astute observation, multilayered modeling, and computation, guided at a critical juncture by a theoretical vision of the hidden world. Of course, in retrospect Descartes was entirely wrong about the rainbow's colors, but his work constitutes a paradigmatic instance, and certainly one of the earliest, of theoretical reasoning grounded in calculation and experiment.

See also *Dioptrics*; Experiment; Explanation; Light; *Meteors*; Optics; Perception; Quality, Sensible

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JED Z. BUCHWALD

RAREFACTION AND CONDENSATION

Whereas most seventeenth-century atomists accounted for rarefaction in terms of the intrusion of tiny void spaces within the particles of a **body**, Descartes devised an **explanation** that was in agreement with his plenist **physics**. Some letters to **Mersenne**, written between 1629 and 1630, bear witness to this attempt. In the first of them, dated October 8, 1629, Descartes praises the explanation of rarefaction provided by a certain doctor, most probably **Sebastian Basso**, although, he adds, "I do not explain the ether as he does" (AT I 25). While Basso believed that rarefaction was caused by a separate ethereal substance entering the pores of material **bodies**, Descartes argued in a subsequent letter that the corpuscles that **cause** rarefaction "are of the same substance of visible and tangible bodies." These corpuscles must not be regarded as **atoms** but as "an extremely fluid and subtle substance" (AT I 140, CSM I 22). Contrary to Basso's ether, Descartes' **subtle matter** is transmutable into the other **elements**, from which it differs only for the size and **shape** of its particles (Ariew 2011).

In another letter to Mersenne, dated February 25, 1630, Descartes explains rarefaction and condensation by using the example of a sponge that expands upon absorbing water and contracts upon being squeezed (AT I 119). This **analogy** reappears in Descartes' works. In chapter 5 of *The World*, one reads that material bodies are, properly speaking, composed only of the third element, although they also contain particles of the other two elements. These bodies can be compared to a sponge, the pores of which "are always full of air or water or some similar fluid," which, however, do not "enter into its composition" (AT X 31, G 21).

The **analogy** of a sponge is invoked in the *Principles of Philosophy* II.6 to explain that rarefaction involves a change of shape of a body's particles but not an increase in its **extension**:

Whatever extension there is in the spaces between its parts must in no way be attributed to it, but to whatever other bodies fill those spaces. Thus, when

we see a sponge full of water or another liquid, we do not think that, in terms of its own individual parts, it has more extension than when it is compressed and dry; but only that its pores are more open, and that its parts are therefore spread over more space. (AT II 43, MM 42)

In *Principles* I.7, Descartes points out that although the expansion of the pores of a body is invisible to us, “we perceive that rarefaction can very easily occur in this way, though in no other” (AT II 44, MM 42).

Descartes is convinced that the common belief according to which a body’s extension changes during rarefaction and condensation represents, together with “the **prejudice** about void,” one of the “two causes which might lead one to **doubt** whether the true nature of body consists in extension alone” (AT VIII 42, MM 41). This is why he puts great efforts into proving that alternative accounts of the phenomenon are untenable. He first takes issue with those “subtle” philosophers who “distinguish the **substance** of a body from its **quantity** (or size), and this quantity from its extension” (AT II 42, MM 41). Here he is most probably thinking of **Francisco Suárez**, who in his *Metaphysical Disputations* XL.2 maintained that the “bulk quantity” (*quantitas molis*) of a body can change without its substance being altered (Suárez 1856–66, 26:533–38; Des Chene 1996, 351; Woolhouse 1993, 84–85, 109).

The atomistic account of rarefaction appears to Descartes equally untenable. After showing, in *Principles* II.18, “how our prejudice concerning an absolute void must be corrected,” he confidently concludes, in II.19–20, that a body cannot be rarefied “in any way other than that explained a little earlier” and that “no atom can exist” (AT II 50–51, MM 47–48).

Rarefaction plays an important role also in Descartes’ account of the circulation of blood (Anstey 2000, 422–23) (see **heart**). In the *Discourse on Method* (1637), as well as in the *Treatise on Man* (finished in 1633) and in the unfinished *Description of the Human Body* (1647–48), Descartes explains that the heart contains a source of heat that produces the rarefaction of the blood entering into the ventricles from the *vena cava* and the *arteria venosa*. The expansion of the heart causes the closure of the five small valves through which the blood entered and the opening of the six small valves located at the entrance of the arteries. “Immediately afterwards, the heart contracts, as do these arteries as well, because the blood that entered them grows cold, and their six little doors close again while the five doors of the *vena cava* and the venous artery reopen,” so that the whole process starts again (AT VI 49–50, CSM I 36; cf. AT X 124–26, G 102–3 and AT X 228–33, G 172–75).

When, at the beginning of 1638, **Vopiscus Fortunatus Plempius** asked how it was possible for the blood to be immediately rarefied upon entering the heart, Descartes answered that one should distinguish between two sorts of

rarefaction: the transformation of a liquid into steam or air, which happens gradually; and the increase in volume of a liquid, which can be either instantaneous or gradual. Instantaneous rarefaction takes place when a liquid's particles "undergo some simultaneous change, which causes them to take up significantly greater space." Diastole happens instantaneously, and "the entire fabric of the heart, the heat in it, and the very nature of the blood all contribute to this effect" (AT I 528–29, CSMK 83; Van Ruler 1995, 151–55). Descartes indicated to Plempius that examples of gradual rarefaction were described in the *Meteors* (1637). The expansion of water turning into air is discussed in the second and fourth discourses of this work, respectively devoted to the formation of vapors and exhalations and to winds (AT VI 239–48, O 269–74; AT VI 265–78, O 287–96). The gradual rarefaction of a liquid is instead described in the first discourse, which explains that, besides heat, also cold can cause rarefaction. If a container filled with hot water is exposed to freezing air, the water level first goes down and then rises again, until the fluid is completely frozen. "The same cold which will have condensed or shrunk it in the beginning will rarefy it afterwards" (AT VI 238, O 268). Descartes warns his readers that this explanation depends on the assumption that the small particles of terrestrial bodies are not atoms, but that "they differ among themselves only as pebbles of many different shapes would differ, had they been cut from the same rock" (AT VI 238–39, O 268).

See also Analogy; Atom; Basso, Sebastian; Body; Element; Extension; Heart; Plempius, Vopiscus Fortunatus; Plenum; Quantity; Subtle Matter; Vacuum

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REASON

Descartes is commonly called a “rationalist” who prized reason above the senses. Yet though the *Meditations* repeatedly describe their aim as “leading the **mind** away from the senses,” it is striking how seldom they refer to reason by name. Descartes does have a distinctive conception of reason, and it plays a fundamental role in the argument of that work. But it operates through some other basic concepts that figure more prominently in this and in others of his writings.

The term *ratio*, though occurring frequently in the *Meditations*, generally means an argument or a reason to believe or do something. Only rarely does it designate the **faculty** of reason. One such passage, reviewing what it is like to suppose that **knowledge** is based on **sensation**, says that since “I remembered having used my senses before my reason ... I easily persuaded myself that I had no **idea** in the **intellect** that I did not have previously in the senses” (AT VII 75, CSM II 52). Here, however, Descartes is referring to the Scholastic doctrine – “nothing in the intellect if not first in the senses” – that the *Meditations* are geared to overthrow. Precisely because the idea of reason was fraught with unwanted associations, he may have been reluctant to invoke it as he laid out anew “the foundations [*initia*] of all first philosophy” (AT VII 9, CSM II 8). Such is indeed the attitude evinced in an earlier passage. Having shown that the proposition “I exist” is necessarily true whenever he conceives it and turning to the question of what this “I” is, Descartes sets aside the stock Scholastic response, a “rational **animal**,” since it would require a detour through the difficult question of “what an animal is, and what rational [*rationale*] is” (AT VII 25, CSM II 17). When he goes on to conclude that his only **certainty** so far concerning his **existence** is that he is a “thinking thing,” he suggests that this **truth** is the proper basis on which the idea of reason should be defined: “a thing that thinks, that is, a mind, or intelligence, or intellect, or reason – words whose meaning I have been ignorant of until now” (AT VII 27, CSM II 18). Yet nowhere in the *Meditations* or in the accompanying Replies to Objections does Descartes offer anything like an explicit **definition** of reason.

All the more incongruous is therefore his appeal to reason at the outset of the First Meditation to impose a quite disputable constraint on what will count as knowledge: “Since reason persuades me that assent should be withheld no less carefully from opinions that are not entirely certain and indubitable as from those that are clearly false, it will suffice for rejecting them all if I discover in each any reason for **doubt**” (AT VII 18, CSM II 12). As the rest of the meditation makes plain in its demolition of the Scholastic view of knowledge as based on the senses, Descartes takes “any reason for doubt” to mean any possibility of falsehood, however improbable, that one lacks an argument to exclude (cf. AT VI 31, CSM I 126–27). So demanding a notion of certainty is not our usual notion, and the *Meditations* unfortunately never say why reason should be thought to require it.

Descartes' understanding of reason is more evident in the earlier *Discourse on Method*, which contains two explicit discussions. The first occurs near the end of part V, where he explains how reason distinguishes man from beasts and **machines**. Reason (*raison*), he asserts, is "a universal instrument which can be used in all kinds of situations." It enables us, unlike them, to be truly language-users, arranging words in diverse ways "so as to respond to the meaning of whatever is said in [our] presence," and to develop a wide variety of skills (AT VI 56–57, CSM I 140). Something of the nature of this "universal" capacity of reason emerges in a second passage at the beginning of part I. There, Descartes equates reason with "good sense" or "the power of judging well and of distinguishing the true from the false" (AT VI 2, CSM I 111). In addition, part I concludes with a remark connecting reason with what he calls "the natural light" (AT VI 10, CSM I 116), and another remark in part III similarly notes that "**God** has given each of us a light to distinguish truth from falsehood" (AT VI 27, CSM I 124), the term "light" being later amended by Descartes to read "a certain light of reason" (*aliquod rationis lumen*) in the Latin translation of the *Discourse* of 1644 (AT VI, 555). In sum, the *Discourse* understands reason as the power of judging by the natural light so as to distinguish the true from the false.

This conception takes on more substance if we now return to the *Meditations* and look at the extensive treatment they do give to the notions of **judgment** and the natural light. Since the latter concept plays the deeper role, I begin with it. The natural light makes its first appearance in the Third Meditation, introduced by way of contrast with "natural inclination," which is merely a spontaneous impulse to believe (AT VII 38–39, CSM II 27). We cannot doubt what is revealed to us by the natural light since we have no higher faculty – "or power of distinguishing the true from the false," the French translation of 1647 adds (AT IX 30) – that is more trustworthy and able to correct it. Often it is immediate, not inferential, truths that Descartes holds to be manifest by the natural light, such as a few pages later the principle that there must be at least as much reality in the efficient and total cause as in the effect of that cause (AT VII 40, CSM II 28). Thus he writes to **Mersenne** in 1641 that "there is nothing in my Metaphysics [i.e., the *Meditations*] which I do not believe to be either very evident by the natural light or demonstrated very precisely" (AT III 284, CSMK 169). Yet sometimes inferential truths too, especially if they are self-evident, are said to be known by the natural light, such as "from the fact that I am doubting it follows that I exist" in the very sentence introducing the concept. In either case, the natural light constitutes our primordial access to truth, such that we have no more reliable means by which we could show that its deliverances are false.

Why this is so comes out in an earlier letter to Mersenne of 1639 (AT II 599, CSMK 140), in which Descartes identifies the natural light with "mental intuition" (*intuitus mentis*). "Intuition" is a key term in the *Rules for the Direction of the Mind* (1628) and largely disappears in the later *Meditations* (though see AT VII 36, CSM II 25) (see **clarity and distinctness**). However, what the *Rules* call "intuition," namely a

grasping of self-evident truths, inferential or not, that “proceeds solely from the light of reason” (AT X 368, CSM I 14), Descartes never ceases to regard as the necessary basis of all knowledge. The natural light is our elemental, intuitive capacity to grasp such truths and thus, as the *Discourse* and the *Meditations* assert, our very power of distinguishing the true from the false. That is the point of the light metaphor.

The natural light forms then the core of Descartes’ conception of reason. Yet as we have seen, he also understands reason as involving the power of judging in accord with the natural light. Examining how the faculty of judgment is guided by the natural light brings out a further fundamental feature of that conception.

The mind, according to the *Meditations*, contains two basic faculties, the understanding or intellect and the will: the intellect presents us with the ideas or propositions that are the subjects of possible judgments, whereas judging that some proposition is true or false is an exercise of the will (see **free will**). Now when, Descartes claims, we “clearly and distinctly perceive” some proposition – that is, grasp through the intellect that the reasons to think it true are such that it could not possibly be false (“clear and distinct perception” is a successor concept to “intuition”) – “from this great light in the intellect there follow[s] a great inclination in the will” (AT VII 59, CSM II 41). In fact, what the light of nature discloses is so compelling that “I cannot but assent to these things, at least so long as I clearly perceive them” (AT VII 65, CSM II 45). Throughout the *Meditations* and the *Replies*, Descartes frequently adverts to this latter doctrine, holding that when we attend to what makes a proposition indubitable, we are compelled to judge or assent to it as true (AT VII 69, 144–46, 166; CSM II 48, 103–4, 117); in letters to Father **Mesland** of 1644 and 1645, he extends the doctrine to the realm of action, claiming that what we clearly perceive to be good we cannot help but pursue (AT IV 115–16, 174–75; CSMK 233–34, 245). Because the compulsion in these cases does not arise from any “external force,” but derives from the cogency of the reasons for assent that we perceive, it does not make us unfree, he adds, but rather represents the highest degree of freedom (AT VII 57–59, CSM II 40–41). The point appears to be that we are freer, the more we think and act in accord with our rational nature, which consists in responding to reasons.

If, then, reason is the power of judging well, as the *Discourse* declares, it cannot be the same as intellect. Reason must involve both intellect and will. To exercise our reason is to let our will be compelled by our intellect, judging to be true only what we through the natural light clearly and distinctly perceive to be indubitable. The *Meditations* and *Replies* never state this conception explicitly; they offer in general no definition of reason. But it is the conception they implicitly embody, given what they say about natural light and judgment, the two central components in the *Discourse*’s discussions of reason.

In the Third Meditation, Descartes considers whether God might have given us a mind whose rule of truth, clear and distinct perception, leads in fact to falsehood.

His effort to vindicate that rule by proving the existence of a nondeceiving God has therefore been rightly described as an attempt to show that reason is reliable, even if he never uses these terms (Frankfurt 2008 [1970]). However, Descartes cannot have understood the reliability of reason to mean, as Frankfurt argues, simply that reason is consistent and will not produce contradictory results, as though he regarded the relation between reason and truth with indifference or assumed a coherence notion of truth. He states plainly that the point of the proof of God is to show that “everything I clearly and distinctly perceive is of necessity true” (AT VII 70, CSM II 48), and truth itself he never defines otherwise than as the conformity of thought with its object (e.g., AT II 597, CSMK 139).

In the *Second Replies*, Descartes does ask why we should care if what we clearly perceive to be true may appear false to God or an **angel**. But he is supposing that we are then attending to what makes some proposition evident, so that we have not “even the smallest suspicion” of its alleged “absolute falsity” (AT VII 145, CSM II 103). Under such circumstances, we cannot help but assent to the proposition’s truth, and truth understood as conformity to reality. The doubt about whether the clearly and distinctly perceived is true is, as he explains on the next page, a doubt we can conceive only when no longer attending to the reasons that make the proposition evident. And the possibility of error it raises is one that the proof of God is held to eliminate. For Descartes, reason’s reliability consists in its really being the guide to truth it purports to be.

See also Clarity and Distinctness; Doubt; Error; Theodicies of; Faculty; Free Will; Intellect; Judgment; Knowledge; Sensation; Truth

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CHARLES LARMORE

RÉGIS, PIERRE-SYLVAIN (1632–1707)

Régis (or Regis) was a prominent but controversial Cartesian at the turn of the eighteenth century. He presented his own opinions in two substantial works, *System of Philosophy* (1690, although completed a decade earlier and initially refused a license)

and *The Use of Reason and Faith* (1704). Appended to the latter was a refutation of the first fifteen propositions of **Spinoza's** *Ethics*; and Régis also entered into polemical exchanges with **Pierre-Daniel Huet**, **Jean Duhamel**, and **Nicolas Malebranche**. His work covers several fields, including **physics** (where he owes much to **Jacques Rohault**, under whom he studied), ethics, logic, and revealed religion, but his most idiosyncratic views are on **metaphysics**. Here, he owes much to **Robert Desgabets**: but, since many of Desgabets' own works remained unpublished at the time, it was Régis who tended to serve as the public face of their shared opinions.

Like Desgabets, Régis acknowledges that he is pushing some points further than Descartes himself had done, but he maintains that these were the conclusions that Descartes should have embraced, had he been true to his own principles. Régis identifies a **substance** with its own **essence** and **existence**, and he maintains that all of these things, as well as the **eternal truths** that characterize such immutable essences, are freely created together by **God** (although he prefers to call these things "perpetual"/"eviternal" and "indefectible," reserving the terms "eternal" and "immutable" for God alone). He holds that there is no need to appeal to the fact that God is not a deceiver to establish the existence of material substance: the mere fact that we can think of it is sufficient to establish that it exists, for otherwise there would be no content to our **idea**. But Régis sharply distinguishes between **body** as such and individual **bodies**. The former is a perpetual and indefectible substance, but the latter are temporal and corruptible "modal beings," defined by the fact that their extensions are modified by certain particular **shapes** and **motions**. The possibility of all of these modifications, and thereby of all individual bodies, is created by God with the substance itself and is known by him through his creative will rather than seen in his own perfections as Malebranche maintains. Their actual existence, however, depends on the activity of prior modal beings, successively bringing new **modes** into being through motion. Régis resists occasionalism, preferring to treat such modal beings as efficient second **causes**, acting by a power borrowed from God, but acting nonetheless. Régis also draws the surprising conclusion that body is indivisible: but by this he means merely that **extension** considered as the indefectible essence of body is such. All particular corporeal modal beings certainly are supposed to be divisible through their "**quantity**," which is extension considered not in itself but in relation to some particular (finite) size (see **divisibility**).

Régis also treats an individual human **mind** as a modal being, temporally subsisting in a perpetual thinking substance, insofar as this substance is modified through a union with a body. His views on the way that individual bodies and souls are related to extension and **thought** are close to **Spinoza's**, although he differs from Spinoza by treating extension and thought as created substances, genuinely distinct from God, whom he regards as supersubstantial. He also distinguishes them from one another, although he maintains that every thought in a man's soul corresponds to some modification in the body to which it is united. The notion of a pure

understanding, independent of the body, is rejected. Even innate ideas depend on the stimulation of the sense organs, for such ideas (e.g., that of extension) differed from adventitious ideas (e.g., of this or that body) only insofar as the former are continuously present in the soul (because we always sense some extended thing or other) whereas the latter come and go. Régis also maintains that the soul is immortal, but by this he means merely that thinking *substance* is perpetual (since it would violate God's immutability for him ever to annihilate something that he had created). What Régis did concede was that everything that is modal in a man is destroyed by death – but, of course, that includes everything that defines a man as a distinct individual person. In this, Régis again approaches Spinoza who, despite insisting that the mind is eternal in some sense, left no room for personal immortality (see **soul, immortality of the**).

See also Body; Cartesianism; Cause; Desgabets, Robert; Divisibility; Eternal Truth; Individuation; Malebranche, Nicolas; Mode; Soul, Immortality of the; Substance

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JASPER REID

REGIUS, HENRICUS (HENDRIK DE ROY) (1598–1679)

Regius, aka Hendrik de Roy, was born at Utrecht, the son of a wealthy family of brewers. After studying law and **medicine** at Franeker, Groningen, and Leiden, he

studied at the universities of Paris, Montpellier, and Padua, where he also took his degree (1623). Back in Utrecht, he became town physician (a honorary position for the care of the poor and the instruction of surgeons). After a short interval as principal of the Latin School at Naarden (1630–34), he returned to Utrecht and resumed his duties as town physician. Descartes' *Discourse on Method* (1637), and especially the accompanying essays *Dioptrics* and *Meteors*, inspired him to elaborate a system of **physics** of his own, which he taught privately to students of the university. In 1638, after a successful lobbying campaign by **Henricus Reneri**, he became professor of theoretical medicine.

Regius sought contact with Descartes, to whom, as he declared in his first letter, he owed his appointment. It was the beginning of a **correspondence** and a friendship, which for both must have been immensely stimulating. Regius submitted draft versions of his disputations to Descartes; Descartes in turn used Regius's activities as an opportunity to test his ideas before a wider audience. Regius's vociferous opposition to traditional **philosophy**, however, produced tensions with his colleagues, especially the theologian **Gysbertus Voetius**. These escalated on December 8, 1641, when Regius had a student defend three claims that caused great alarm: the union of **mind** and **body** is "accidental" (see **human being**); the earth moves; and Aristotelian substantial forms must be rejected (see **form**, **substantial**). Although Voetius convinced the theological faculty that an official reaction was needed, the administration of the university achieved a compromise: it refused to condone an open condemnation of Regius but allowed Voetius to defend the traditional position and publish his apprehensions about the rejection of substantial forms. Things might have ended there, had not Regius and Descartes the idea that a public reaction was needed. A *Responsio*, written by Regius in collaboration with Descartes, was published in February 1642. It caused so much offense that Voetius managed to obtain an official condemnation of the new ideas. Regius lost his permission to lecture on general physics and was confined to the medical faculty.

In the years that followed, the relation between Regius and Descartes also became strained. Already in 1641 Regius wanted to publish a book. Descartes opposed that plan and suggested that Regius limit himself to disputations. Regius, however, continued to work on his book, which was ready by 1645. It contained a complete mechanical physics, that is, a theory not only of material **bodies** but of plants, **animals**, and men as well. He sent the manuscript to Descartes, who reacted with dismay: Regius not only failed to prove his ideas; what he said about the nature of the soul and the **idea** of **God** was utterly false. He threatened to openly dissociate from Regius if the book were published. Despite the fact that in the preface to *Fundamenta physices* (1646) Regius carried through a few changes and in the preface declared that he alone was responsible, Descartes denounced his friend in the most violent terms in the preface to the French translation of his *Principles of Philosophy* (1647). In reaction, one of Regius's students published a pamphlet in which he restored Regius's original claims, including those

he had removed from his book in order to pacify Descartes, and to which Descartes in turn reacted with *Comments on a Certain Broadsheet* (1648). Meanwhile Regius continued to lecture and publish on medicine. In 1647 he published his *Fundamenta medica* on the theory of medicine and in 1657 a *Praxis medica* containing descriptions of successful treatments. Expanded editions of *Fundamenta physices*, now under the title *Philosophia naturalis*, were published in 1654 and 1661—this last edition dedicated to Charles II, who gave Regius a knighthood. When in 1657 **Clerselier** started his edition of Descartes' letters, Regius refused all cooperation. The letters of Regius to Descartes, though, were in the possession of **Baillet**, who quotes from them in his *Vie de M. Descartes* (1691). Regius died at Utrecht on February 19, 1679.

Often presented as someone who, after taking everything from Descartes, ungratefully turned away from him, Regius was never seen as a very original figure. That judgment is incorrect. Despite his admiration for Descartes, Regius was never a slavish follower. Empirically minded, he always kept his reservations on the great metaphysical and epistemological questions and in *Fundamenta physices* laid the foundations for an original theory of **knowledge**, which in many ways anticipated **Locke's Essay** (1689). He now denies the existence of innate ideas and a pure **intellect** for the same reason as he denies substantial forms: they are simply not needed, not even to explain the idea of God, which according to him has like all other ideas its origin in sense **perception**. Even though the mechanical **explanation** of the world is the best available, it is, like all explanations referring to invisible entities, no more than provisional. Turning to human nature he declares that "as far as the nature of things is concerned, it seems possible for the soul to be either a **substance** or a **mode** of a physical substance." Given the fact that the **attributes** of **extension** and **thought** are not opposite but simply different "there is nothing to prevent the mind from being an attribute of some kind which applies to the same subject as extension, even though neither attribute is included in the concept of the other" (see AT VIIIB 342–43, CSM I 294–95). Questions like the immateriality and immortality of the soul can be solved only with an appeal to scripture (see **soul, immortality of the**). Regius's importance for medical theory is reflected in the fact that until the posthumous publication of Descartes' *Treatise of Man* (1662), his works were virtually the only source of a more elaborate Cartesian physiology.

See also *Comments on a Certain Broadsheet*; Form, Substantial; Human Being; Mind; Physics; Reneri, Henricus; Schoock, Martinus; Soul, Immortality of; Voetius, Gysbertus

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THEO VERBEEK

RENTERI, HENRICUS (HENRI REGNIER) (1593–1639)

Born in Huy (near Liège) and educated at Louvain (Collège du Faucon) and the Liège Seminary, Renteri was destined for the priesthood. However, he converted to **Calvinism** and fled to Leiden, where he pursued his theological studies at the university. After a period as private tutor, he became professor of philosophy at the Illustrious School of Deventer in 1631. In 1634 he exchanged this position for a professorship in philosophy at Utrecht, where he died five years later. Descartes must have known Renteri right from the beginning of his stay in the Netherlands, in 1629. Not only did they become intimate friends, but Renteri was instrumental in creating Descartes' Dutch network. Unlike **Mersenne**, he seems to have done that with great discretion (there were even complaints that he was shielding Descartes from the outside world). Although Renteri was a great admirer of Descartes, he was not a Cartesian. A Baconian of sorts (in Utrecht he pleaded for the appointment of an official fact-collector, who would go to Amsterdam and interrogate mariners and artisans) and involved with the Hartlib Circle, he seems to have been fairly traditional and eclectic in his teaching. In fact, his position is difficult to assess given the fact that, apart from a dozen disputations, he did not leave any writings. The funeral address at his death, written and pronounced by the professor of history Antonius Aemilius (1589–1660), derailed into an excessive eulogy of Descartes and caused something of a scandal.

See also Calvinism; Mersenne, Marin; Regius, Henricus

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THEO VERBEEK

REPRESENTATION

Representation (Latin *repraesentatio*, French *représentation*) is not a technical term for Descartes. He offers no definition of it and has no explicit theory of it. While representation is a central concept in today's theory of **mind** (along with intentionality and consciousness), early modern theories of mind center on the cognitive faculties (**intellect**, **imagination**, **memory**, senses). That does not mean the concept of representation plays no role in Descartes' theory of mind; it simply means that we have to do some rational reconstruction to determine what that role is.

1. PRELIMINARIES

In the seventeenth century, *repraesentare* and *représenter* mean many things, but their chief meaning is *to present* something or *make something immediately available*. One can represent a gift to a friend or a sum of money to a creditor. But the verbs can also mean making something present *by way of a proxy or substitute* for the thing itself. In this latter sense, a lawyer represents his client. Most cases of philosophical interest fall somewhere in between the two: when an actor represents Henry VIII on the stage, there is a sense in which he is making Henry VIII present to the audience, although he is just a proxy or substitute for Henry himself. The ambiguity found in this case animates discussions of representation in the theory of mind: mental states make objects, facts, and states of affairs present to the mind, but do they do so by means of proxies or substitutes for those objects, facts, and states of affairs? If they do employ proxies, what are the epistemological and metaphysical consequences? And whether or not they employ proxies, *how* does a mental state manage to represent something distinct from itself? These are questions an account of mental representation must answer.

2. EPISTEMOLOGY OF MENTAL REPRESENTATION

The question whether Descartes was a "direct realist" or an "indirect realist" has occupied commentators since Reid in the eighteenth century cast him in the latter role. At issue is whether **thought** (including both sensory and intellectual **perception**) involves mental representations that mediate epistemologically between mind and world. Direct realists insist that the mind is in immediate epistemic contact with its object. Indirect realists hold that thought is epistemologically mediated by mental representations; for example, in seeing a cupcake on my desk I am immediately aware of a mental representation of a cupcake and only mediately aware of

the cupcake itself. Following Reid, the indirect realist reading had many followers (Kenny 1968, Rorty 1979, Wilson 1999), but in the 1970s and 1980s a surge of commentators argued that Descartes is in fact a direct realist, at least in the case of primary-quality perception (Arbini 1983, Cook 1987, MacKenzie 1990, Nadler 1989, O’Neil 1974, Yolton 1984). The terms of this debate are frequently unclear, and accounts differ dramatically on each side. What is especially unclear is whether merely taking **ideas** to be representations commits Descartes to indirect realism. It depends on whether the mind simply *has* ideas-cum-representations (and, in virtue of having them, directly perceives a physical object) or actually *perceives* them (and so has to then *infer* that a physical object lies on the other side of it).

The debate initially turned on whether Descartes treats ideas as *acts* of thought or as *objects* of thought (Kenny 1968). If the former, he is a direct realist. If the latter, he is an indirect realist. This way of asking the question, however, is too simple. Descartes distinguishes two senses of the term “idea”: a “material” and an “objective” sense (AT VII 8, CSM II 7). Following Chappell (1986), I call them $idea_m$ and $idea_o$. $Ideas_m$ are acts of thinking (sensing, imagining, understanding). $Ideas_o$ are representations of things (a cupcake, the nature of a triangle, **God**). The question, then, must be reformulated: what is the relationship between $ideas_m$ and $ideas_o$? Are they two distinct things, such that we can say that $ideas_m$ *perceive* $ideas_o$? If so, Descartes looks like an indirect realist, with $ideas_o$ playing the role of epistemic proxies for things. Or are $ideas_m$ and $ideas_o$ simply two aspects of a single thing? If so, Descartes may be a direct realist: $ideas_o$ may be *metaphysical* proxies for things that provide a perceptual act with its content, but not *epistemic* proxies acting as an object for any perceptual act.

Although most commentators today deny the coherence of saying that Cartesian $ideas_m$ *perceive* $ideas_o$, there is little agreement on just what their relationship is. There is some reason to think they are just two aspects of a single modification of mind that are only rationally distinct (see **distinction [real, modal, and rational]**). When Descartes introduces the distinction, he depicts the $idea_o$ as “the thing represented *by that operation of the intellect*,” that is, by the $idea_m$ (AT VII 8, CSM II 7; emphasis added). There seems to be only one thing here: a representational act of thought. But insofar as it seems possible to mix and match $ideas_m$ and $ideas_o$ (say one’s surprise at a lion gives way to fear of the lion), one might argue that they are at least modally distinct, like a ball’s color and **shape**: no $idea_m$ can exist without *some* $idea_o$, but which one it coexists with is up for grabs. Finally, to the extent that $ideas_m$ and $ideas_o$ are granted different kinds of being or reality (formal and objective, respectively), one might argue that they have an even greater measure of independence (see **being, formal versus objective**). At the very least, the issue is more complicated than the early literature suggested, and deciding whether Descartes is a direct or indirect realist is unlikely to be decided simply by examining his account of ideas.

3. THE SCOPE OF REPRESENTATION IN THE CARTESIAN MIND

Another much debated question concerns the scope of representation in Descartes' theory of mind: Do all Cartesian thoughts represent something, or are there thoughts that represent nothing? Before looking at contested cases, let's ask what role representation plays in Descartes' general conception of mind. This question is itself a matter of debate, and how one answers it has consequences: if the Cartesian mind is essentially a representing thing, then there is pressure to read all Cartesian thoughts as representational.

The Cartesian mind is essentially a thinking thing. But what is thought? There was a tendency in the middle of the twentieth century to identify Cartesian thought with consciousness (Kenny 1968), which would allow for thoughts that are conscious but nonrepresentational. The identification of thought with consciousness seems to be inspired largely by the **definitions** of thought in the *Principles* and Second Replies; the laundry list of thoughts that Descartes includes in his description of the mind in the Second Meditation (AT VII 28, CSM II 19); and the occasional use of the phrase "thought or consciousness" suggesting their interchangeability. None of the three possibilities is decisive. The definitions say not that thought *is* consciousness but rather that thought is what the mind is *conscious of*. The laundry list might pick out a range of *representational* states as much as range of *conscious* states. And the occasional phrase "thought or consciousness" occurs in places where Descartes is offering a quick and easy way to distinguish mental from corporeal **substances** without getting into the details of its nature (AT VII 176, CSM II 124; AT III 474, CSMK 201).

Descartes frequently identifies thought with intellection (AT VII 27, CSM II 18; AT VII 78, CSM II 54; AT VIIIA 23, CSM I 208). Even sensing, he says in the Sixth Meditation, "includes intellection in its formal concept" (AT VII 78, CSM II 54). What, then, is intellection? Several commentators have suggested that in one way or another intellection involves representation (Alanen 2003, Broughton 2008, Carriero 2009, Hatfield 2003, Rozemond 1998). To the extent that all Cartesian thought involves intellection, it will also all involve representation.

Further evidence that all Cartesian thought is representational comes from his technical **language**. Descartes frequently uses the terms "thought" (*cogitatio*) and "idea" (*idea*) interchangeably (AT VII 35, CSM II 24), but he says that strictly speaking ideas are "as it were images of things" (*tanquam rerum imagines*) (AT VII 37, CSM II 25; see also AT VII 44, CSM II 30). Thoughts may include "extra forms" in addition to ideas: "When I will, or am afraid, or affirm, or deny, there is always a particular thing which I take as the subject of my thought [an idea strictly speaking], but my thought includes something more than the likeness of that thing" (AT VII 37, CSM II 25–26). To the extent that ideas strictly speaking are "as it were images of things," they must be representations of things. And since all Cartesian thoughts

include ideas strictly speaking, they must be *at least* representations. (It is worth noting that Descartes sometimes includes the attitudinal “extra forms” under the general umbrella “idea” [AT VII 181, CSM II 127], but in these passages he arguably uses the term “idea” loosely, and not *strictly speaking*. Since these extra forms always occur with an idea strictly speaking, they do not jeopardize the claim that all Cartesian thoughts [as a whole] are representational.)

The wholesale representationality of Cartesian thought is further suggested by Descartes’ insistence that ideas all have “objective being” by their very nature (AT VII 42, CSM II 29). Objective being is “the being of the thing represented by an idea insofar as it is in the idea” (AT VII 161, CSM II 113; see also AT VII 8, CSM II 7; AT VII 40, CSM II 28; AT VIII 11, CSM I 198). The notion of objective being traces back to Descartes’ Scholastic predecessors, and just how to interpret it is a vexed matter (see **being, formal versus objective**). What is clear is that in virtue of having objective being, ideas represent things. (Note: Descartes confusingly makes the same point with different terminology in his Fourth Replies to **Arnauld**. Here, to consider an idea insofar as it represents this or that is to consider it *formally* as opposed to considering it *materially* as an act of thought; he draws here on the Aristotelian claim that the forms of objects inhere in the cognitive faculty of the cognizer [AT VII 232, CSM II 163].)

The evidence is strong, then, that representation lies at the heart of the Cartesian mind.

4. METAPHYSICS OF REPRESENTATION IN SENSATIONS AND PASSIONS

We have considered some general reasons to interpret all Cartesian thoughts as representational, but scholars still divide on particular cases. Nobody denies that the mind’s clear and distinct intellectual perceptions represent; they represent **true and immutable natures** (of God, mind, **body**, geometrical objects, etc.). What is hotly contested is whether the obscure and confused perceptions that arise from the union of mind and body (**sensations** and **passions**) represent anything, and, if so, how and what they represent.

a. Sensations

At issue is whether secondary-quality sensations (sensations of color, odor, flavor, sound, hot, and cold) and internal sensations (sensations of pain, tickling, hunger, and thirst) represent anything. Nobody denies that primary-quality sensations (sensations of size, shape, position, and **motion**) represent genuine features

of bodies. Some people deny that we *have* primary-quality sensations, arguing that primary-quality perception, even in sensory experience, is always *intellectual* (Arbini 1983, Jolley 1990, Secada 2000, Wilson 1999). To keep things simple, I use “sensations” to refer only to secondary-quality sensations and bodily sensations.

Descartes’ account of the causal production of sensations sets the backdrop for discussions of their representationality. The account is purely mechanical from object to brain: objects in the world produce local motions in the medium, which in turn produce local motions in the sense organs, which in turn produce local motions in the brain. Motions in the brain give rise to (i.e., **cause** or occasion) sensations in the mind according to psychophysiological institution of nature established by God (AT VI 130, CSM I 167; AT VII 86–89, CSM II 59–61). Descartes insists that the causal process does not rely on resemblance: motions in the brain need not resemble the objects that initiate the causal chain; and sensations in the mind need not resemble either the motions in the brain that proximately cause them or the objects that distally cause them (AT XI 4–10, CSM I 81–84; AT VI 81–86, 109–14, 130–32, CSM I 152–54, 164–66, 167–68). Descartes explicitly rejects the Scholastic Aristotelian causal account *because* of its reliance on resemblance (AT VI 112, CSM I 165; AT VIIIA 322, CSM I 285). Descartes’ rejection of resemblance here has consequences for any account he might have given of mental representation: the sensations resulting from this process either *do not represent* anything outside the mind (if representation requires resemblance) or *represent* things *without resembling* them. Commentators have defended each option.

1. Nonrepresentational. Commentators arguing that sensations do not represent anything maintain that they are like mental bruises: they are *caused* by things outside the mind, but do not in turn *represent* anything outside the mind (Keating 1999, Nelson 1996, MacKenzie 1990). The strongest textual evidence for this view is *Principles* I.71, in which Descartes describes such sensations as taste and color as “sensations that do not represent [*repraesentant*] anything located outside our thought” (AT VIIIA 35, CSM I 219). Sensations *seem* to represent things outside the mind, the argument goes, because we habitually refer them to objects by (falsely) judging that there is something in objects that resembles our sensations (AT VII 35, 75, 82–83, CSM II 24–25, 52, 56–57; AT VIIIA 32, 35–36, CSM I 216, 218–19; AT XI 346, CSM I 337). If we isolate our sensations from these habitual **judgments**, the story goes, we will experience them as they really are: simple modifications of consciousness (see **habit** and **prejudice**).

This view has important corollaries. First, it fits most naturally with the view that consciousness constitutes the nature of the Cartesian thought: sensations are thoughts, but if they are nothing more than modifications of consciousness, then the common features among thoughts must be consciousness. Second, sensory experience on this view is deeply bifurcated into (a) nonrepresentational sensations “of” secondary qualities (the genitive here is merely descriptive, indicating what kind of

sensation is had) and (b) fully representational perceptions of primary qualities (the genitive here is an objective genitive, indicating what the object of the perception is). Third, colors, smells, pains, and the like are most naturally read as aspects of the *formal* rather than the *objective* reality of ideas, since the latter is a representational feature of ideas and sensations have no representationality (and so, presumably, no objective reality). Fourth, it suggests that Descartes is a sensationalist about secondary qualities: since they do not *represent* color properties, sensations of color must *be instances* of color properties (see **quality, sensible**). Fifth, on this view, Descartes' claims that sensations are obscure and confused, and materially false, cannot be read as saying that sensations intrinsically misrepresent their objects (since they have no objects); he can only mean that sensations are extrinsically mixed up (or con-fused) with the habitual judgments we make about them, resulting in an overall misleading experience of the world as colored, smelly, tasty, and the like. Sixth, sensations contribute to our knowledge of the world only by our being able to *use* them as more or less reliable signs for we-know-not-what differences in the world that cause them. Commentators arguing *against* this view typically argue that one or more of these corollaries is anti-Cartesian (see De Rosa 2010, Pessin 2009, and Simmons 2003).

2. Representational. Increasingly, commentators have come to argue that sensations are representational in and of themselves, that is, independent of any habitual judgments we make on their occasion. There is considerable disagreement, however, about *what* and *how* sensations represent.

Some commentators argue that sensations represent **modes** of **extension**, typically the mode of extension that serves as their distal bodily cause (e.g., color sensations represent surface textures or the spin that that surface puts on light particles), and that they do so in virtue of a systematic *extrinsic* relation in which they stand to those modes of extension. Larmore (1980) suggests that sensory representation is grounded in the systematic covariation between sensations and the modes of extension that distally cause them. Wilson (1999) grounds what she calls a sensation's "referential representationality" in the mechanical causal relation that links it to a mode of extension. Taking a rather different tact, Schmaltz (1992) and Hoffman (2002) ground sensory representation in Descartes' principle that ideas contain objectively what their distal causes contain formally or eminently; although objective reality is intrinsic to an idea, they maintain that it is grounded in the formal reality found in its distal cause – an idea's objective reality, after all, just is the objective being *of that distal cause*. Drawing on texts in which Descartes says that our senses show us bodies not as they are in themselves but as they are related to our well-being, Alanen (2003) insists that sensations represent not modes of extension but the ways in which the mind-body union is affected by extended bodies, and that their representationality is grounded in the contingent extrinsic connection instituted by nature between motions in the brain and sensations in the mind.

One general advantage of extrinsic accounts is their ability to make sense of misrepresentation and **material falsity**, that is, cases of mismatch between what a sensation *seems* to represent and what it *in fact* represents. Since what a sensation *really* represents is determined extrinsically, there is no mystery that from the inside we may not know (and may even mistake) what our sensations represent to us; we are, perhaps, distracted by their intrinsic phenomenal properties. There are, however, notable disadvantages. First, it is difficult to find a principled way to isolate the distal cause of the sensation as its *res repraesentata*, since (a) in illusory cases (such as the phantom limbs Descartes was fascinated by [see **sensation**]), the resulting sensation is the same as the normal case, but there is no distal cause to fix its object (do these sensations *not* represent after all, or does their representationality piggyback somehow on the normal cases?); and (b) the proximate cause (motions in the brain) arguably has a better case than the distal cause to serve as the *res repraesentata* for a sensation since it is both a necessary and sufficient cause of the sensation (the distal cause is neither). It is clearly *intrinsic* features of the sensation that make us want to identify the distal cause as the *res repraesentata*. Covariation and causation are not enough. Moreover, it is not clear why a pain and a color sensation represent, but a bruise does not, when each is but the causal result of (and covaries with) a punch. We need an account of when covariation and causation yield representation, when they do not, and why.

Other commentators argue that sensations *intrinsically* represent things but do not reveal the nature of what they represent because of their obscurity and/or confusion. Brown (2006) and Pessin (2009) both argue that a sensation's representationality is due to its intrinsic objective reality. They disagree, however, about what a sensation's objective reality is, and so about what it represents. Pessin (2009) argues that a sensation represents the modes of extension that distally cause it (and which exist objectively in the sensation); he casts the phenomenal character of a sensation as a mere appearance that has neither formal nor objective reality but that nonetheless impedes our view of what is being intrinsically represented to us by the sensation. Brown (2006) argues that sensations represent *themselves*; that is, their objective reality corresponds to their own formal reality. In referring them to bodies by habitual judgments, however, we come to misrepresent them as modes of body. Taking a different line, De Rosa (2010) argues that sensations represent in virtue of an intrinsic but latent *intellectual* content that is present in all sensations but is obscured by the phenomenal character that they have in virtue of the mind's causal interaction with matter.

These commentators avoid the obvious problem with intrinsic accounts of representation: if representation is intrinsic, shouldn't we know from the inside what our sensations represent? They deny this implication by marking an appearance-reality distinction *within the mind*. Sensations are *too obscure* for us to discern their intrinsic

contents from the inside, or we *render them obscure* by confusing them with habitual judgments that we make. Their representational content is thus hidden from our view.

Yet other commentators maintain that Descartes has a hybrid notion of representation that mixes intrinsic and extrinsic features, at least for sensations. In a landmark article on the topic, Wilson distinguishes a *presentational* and a *referential* sense of representation. A sensation presentationally represents its phenomenal character; it referentially represents the modes of extension that distally cause it (Wilson 1999). Like Alanen (2003), Simmons (1999) casts the representationality of sensations as something to be understood in the context of the mind-body union, arguing that sensations represent ecologically salient features of objects (e.g., pain represents harm, color sensations represent macroscopic surface differences) and do so in virtue of a combination of their intrinsic phenomenal character (pain intrinsically alerts us to something bad) and the functional role they play in the life of a mind-body union negotiating a world of objects that can affect it for good or ill (pain regularly occurs when some part of the body is harmed).

The obvious disadvantage for these hybrid views is that they fail to give Descartes a single coherent account of the representationality of sensations. On the other hand, since Descartes does not explicitly take on the topic, it would not be surprising if he lacks a single coherent account but draws on different conceptions depending on the context.

b. Passions

The question whether Cartesian passions represent anything is complicated by an ambiguity in what constitutes a passion. Passions, like fear of a lion, are among the thoughts that include an idea proper (idea of a lion) plus some additional form (the fear). If the whole complex constitutes a passion, then they clearly represent: fear of a lion represents a lion. But the issue among commentators is whether that extra form itself (call it the “passion proper”) represents anything, or whether it is merely a feeling that accompanies our perceptual (i.e., sensory, imaginative, or intellectual) representation of an object.

Some commentators suggest that the passions are akin to bodily sensations in that they (confusedly) represent physiological states of one’s own body. When I feel fear in the presence of a lion, that fear represents something like my increased heart rate (James 1997, Wilson 1999). This reading makes it difficult not only to distinguish bodily sensations from passions but also to explain the evaluative and motivational impact of the emotions. Passions are clearly *caused* by states of one’s body, but they seem not to be representing those states.

Others argue that the passions modify the content of our perceptual representations of things. Hatfield (2007) and Hoffman (1991) suggest that they are responsible for the evaluative content of a representation – namely, our representing something *as good or bad* for the embodied mind. Similarly, Alanen (2003), Brown (2006), and Shapiro (2012) suggest that the passion proper effectively gets into the content of the representation adding an element of behavioral significance, so that through them we represent things *as fearful* or *as lovable*. Passions, then, are representational states that have evaluative content. This reading has a lot of texts on its side (e.g., AT XI 342, 347, 387, 431–32; CSM I 335, 337, 356, 377). It also respects Descartes' taxonomy by placing passions alongside the other obscure and confused perceptions *as obscure and confused representations of things* – namely, of the good/bad, benefit/harm of things. On the other hand, Descartes routinely suggests that sensations already represent objects as good/bad, beneficial/harmful (AT VII 83, CSM II 57; AT VIIIA 41, CSM I 224; AT XI 430, CSM I 376). Why would the passions repeat what is already done by the senses? Moreover, in emphasizing the evaluative role of the passions, this reading neglects the motivational function of the passions: Cartesian passions do not simply *inform* us of harm the lion may cause but *prompt us to act* in an appropriate way.

Other commentators maintain that the passions proper do not represent anything, though they essentially occur in conjunction with a very special kind of representation: a representation not simply of a lion but of the relation that the lion bears to my well-being as the embodied mind. (The evaluative component, on this reading, is already built into the sensory, imaginative, or intellectual representation of the object.) Passions, on this view, are at bottom motivational states whose job is to incline the will to take special note of, and initiate action with respect to, the things that are perceptually represented as beneficial or harmful to the embodied mind (Rorty 1986, Greenberg 2007, Schmitter 1994). This account makes good sense of Descartes' claim that the function or use (*usage*) of the passions is to *dispose* or *incite* the soul to will to do what is beneficial for the mind-body union (AT XI 372, CSM I 349; AT XI 430, CSM I 376). Moreover, although Descartes does align the passions with sensations and bodily sensations as obscure and confused perceptions, he also differentiates them. One difference is that only the passions are caused by motions in the brain that influence the will (AT XI 365, CSM I 346). This again suggests the passions ought to be thought of as chiefly motivational.

5. CONCLUSION

Although Descartes gives no explicit theory of representation, his other commitments in the philosophy of mind strongly suggest that all Cartesian thoughts

have at least a component, an idea proper, that represents something; there are no stand-alone feelings in the Cartesian mind. Whether the status of ideas proper as representations commits Descartes to a form of epistemological indirect realism is debated but today largely dismissed. Just what and how ideas proper, and the more complex ideas that merely include ideas proper, represent remains a topic of lively discussion.

See also Being, Formal versus Objective; Cause; Clarity and Distinctness; Distinction (Real, Modal, and Rational); Falsity, Material; Idea; Intellect; Mind; Passion; Perception; Sensation; Thought

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ALISON SIMMONS

ROBERVAL, GILLES PERSONNE DE (1602–1675)

Roberval was born as Gilles Personne in the small village of Roberval near Senlis, France. His father was a poor farmer or farmworker, and his mother is said to have given birth to him in a field. At the age of fourteen, his intelligence recognized, Gilles

Personne was given instruction in **mathematics** and languages by a local priest. He later earned his living as an itinerant teacher of mathematics. After witnessing the siege of La Rochelle, he supplemented his mathematical **knowledge** through studies in fortification and ballistics. Arriving in Paris shortly afterward, in 1628, Roberval soon became a member of the circle around **Mersenne** and later of the Académie de Montmor. Around 1630 he was given permission to append “de Roberval” to his surname. In 1632 Roberval was appointed professor of philosophy at Collège de Maître Gervais in Paris, a small institution attached to the university, and he lived in austere rooms there until his death. He never married. Roberval competed successfully for the Ramus chair in mathematics at the Collège Royal and was appointed in 1634. Required by the statutes to submit to open competition every three years, he nonetheless kept this post until the end of his life.

Descartes and Roberval disliked each other intensely. Unimpressed by the **Geometry**, Roberval sent his critical comments to its author through their mutual friend Mersenne. Their animosity increased further when Roberval defended **Fermat’s** method of tangents against criticism from Descartes (AT II 104–14). From this point onward, the two men engaged in dispute on many questions from methods for determining centers of gravity to the nature of space and **body**. When Roberval published what was purportedly the Latin version of a newly found Arabic script of a lost work of Aristarchus, but was in fact his own affirmation of the Copernican hypothesis, Descartes poured ridicule on the book. In particular, he noted that the supposed properties of matter were inconsistent with a spherical universe (AT IV 402).

Little of Roberval’s work appeared in his lifetime. His *Traité de mécanique* was first published in Mersenne’s *Harmonie Universelle* (1636), while his cosmological work *Aristarchi Samii de mundi systemate ... liber singularis* appeared in 1644. Mersenne ensured the latter’s wider distribution by republishing it in his *Novarum observationum tomus III* (1647). The requirements of the Ramus chair evidently encouraged Roberval to hold back the publication of his mathematical discoveries, leading him to become embroiled in a series of disputes over priority in discovery after others had published first.

A close acquaintance and ally of **Hobbes** during his exile in Paris, Roberval made important contributions to the mathematical calculation of areas and volumes by means of his method of indivisibles. He was a pioneer in kinematic **geometry** and innovative thinker in **mechanics**, inventing what came to be known as the “Roberval balance.”

Roberval was a founding member of the Académie Royale des Sciences and one of its most active contributors during the early years. He died in Paris in October 1675, leaving his extensive mathematical papers to the Académie on the understanding that they be published posthumously.

See also Fermat, Pierre; *Geometry*; Hobbes, Thomas; Mathematics

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PHILIP BEELEY

ROHAULT, JACQUES (1618–1672)

Born at Amiens, Rohault studied in the **Jesuit** college of his home city and then moved to Paris, where he became known as a professor of **mathematics**. He was the son-in-law of **Claude Clerselier**, the editor of Descartes' unpublished writings, and as a result of this connection became a lightning rod of the Cartesian movement in France. Besides hosting some of the most famous Parisian conferences of his time – “the Wednesday meetings” – Rohault got actively involved in the dissemination of **Cartesianism** by sending **Pierre-Sylvain Régis** to teach Descartes' **philosophy** in Toulouse. From the philosophical point of view, he presents his achievements as a combination of Aristotle's and Descartes' thought, to which he adds something new, namely an experimental methodology.

Rohault published only two books during his life: the *Traité de physique* (1671a) and the *Entretiens sur la philosophie* (1671b). While the first aims at providing a textbook on natural philosophy, the second represents his answer to the increased debates about **transubstantiation** in France during the 1660s. More metaphysical in character, the *Entretiens* represents Rohault's contribution to the debate over forms and accidents. Relying on a Cartesian theory of matter, he appeals to Scholastic **explanation** in terms of matter, form, and privation. However, even if his taxonomy might look traditional, Rohault is very Cartesian in his explanation. He reduces the three Aristotelian principles of matter, form, and privation to simple properties of matter, something that is much better clarified by his *Traité* (see **form**, **substantial**).

More systematic in structure, the *Traité de physique* was a very influential book from its publication up to the middle of the eighteenth century, in France and elsewhere, including Louvain, Cambridge, and Utrecht. Quickly translated and published in Latin, this book was significant for the evolution of mechanical philosophy even in the context of the birth and development of Newtonianism. Moreover, in England, numerous editions of Rohault's treatise were accompanied by annotations from the celebrated Newtonian, Samuel Clarke. Varying in length and theme, Clarke's notes contribute to a range of debates in natural philosophy, by pointing out

both the strengths and the weaknesses of Rohault's Cartesian solutions. Presented by many – including the French historian of Cartesianism, Paul Mouy – as the most important experimental physicist among Descartes' followers, Rohault convincingly blends theory with experience. His **method** of scientific inquiry ascribes a more important role to **experiment**, which is clearly differentiated from experience or mere observation. For Rohault, an experiment should be performed in order to test a hypothesis, thus linking it with the theory. However, it is not clear how experimental results can influence theory, as his defense of the Cartesian view that vacua are impossible witnesses. Found at the core of any Cartesian theory of matter, the rejection of the **vacuum** was challenged in the late seventeenth century on both empirical and theoretical grounds. Rohault enters this debate, performing experiments with his own air pump and providing explanations based on the identity between **body** and **extension**. Hence, despite his methodological novelties, Rohault remains a dedicated Cartesian on the central issues of the seventeenth-century **physics**. His Cartesian treatise of physics puts this discipline on a more modern basis, bridging the gap between speculative and experimental approaches of the period.

See also Body; Clerselier, Claude; Experiment; Extension; Form, Substantial; Mechanics; Metaphysics; Newton, Isaac; Physics; Quality, Real; Régis, Pierre-Sylvain; Transubstantiation; Vacuum

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MIHNEA DOBRE

ROSICRUCIAN

Descartes’ early account of a proposed reform of the mathematical sciences, *The Mathematical Thesaurus of Polybius Cosmopolitanus* (1619), was dedicated to “learned men throughout the world, and especially to the F.R.C. very famous in G[ermany]” (AT X 241). This was a reference to the Frères de la Rose Croix, or the Rosicrucian Brotherhood, who were just then creating a stir among the learned throughout Europe. When Descartes returned to Paris in 1623, after a trip to Germany (where he had met Johannes Faulhaber [1580–1635], who had publicly expressed an interest in joining the brethren), he was obliged, as a known would-be reformer of **knowledge**, to deny his affiliation to the Rosicrucians. It is possible that Descartes’ shift in November 1619 from mathematical reform to a reform of knowledge more widely was inspired by Rosicrucianism; certainly the fact that he recounted his inspiration in the form of three dreams (supposedly experienced on the night of November 10) has echoes of Rosicrucianism (see **dreams, Descartes’ three**).

First recounted in two manifestoes, the *Fama Fraternitatis* (1614), and the *Confessio Fraternitatis R. C.* (1615), Rosicrucianism advocated a radical reformation of knowledge. Inspired by supposed contemporary achievements in the occult sciences, the manifestoes hint at a new **method** of directing and ordering studies according to supposedly sound and sure foundations. It seems that the fraternity never really existed, however. Certainly, those like Faulhaber and Descartes who hoped to meet with a representative of the brethren never succeeded. It seems to have been a fiction developed for allegorical purposes, most likely by Johann Valentin Andreae (1586–1654), who certainly wrote what has been seen as the third Rosicrucian manifesto, the *Chemical Wedding of Christian Rosencreutz* (1616). Within a year of publishing the *Chemical Wedding*, however, Andreae – evidently appalled by the way Rosicrucianism was taken up, and changed, by supporters (sometimes claiming to be brethren) – shared the view of opponents of Rosicrucianism that its occultism represented a threat to sound religion. The movement, insofar as there ever was a movement, soon died out. It has no continuity with modern groups who call themselves Rosicrucians.

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JOHN HENRY

RUBIUS, ANTONIUS (RUBIO, ANTONIO)
(1548–1615)

Rubius (sometimes spelled “Ruvius”) was born in Villa de Rueda, Spain, and joined the **Jesuit** order in 1571. He was a student of **Franciscus Toletus** at the Colegio Máximo de Alcalá de Henares and served as professor of philosophy at the Colegio Máximo de San Pedro y San Pablo in Mexico from 1576 to 1601. He received his doctorate from the University of Mexico in 1594 and was appointed **Jesuit** procurator in Rome in 1601. He spent the remainder of his career teaching at Alcalá, where students learned logic from his commentary on Aristotle’s logic, popularly referred to as the *Logica Mexicana* (Robles 2003, 399). His commentary on Aristotle’s *Physics* was likewise widely used as a textbook and both works went through several editions. Descartes had to study at least some of his works at the Collège de la Flèche, as evidenced by his request to **Marin Mersenne** on September 20, 1640: “I beg you to send me the names of the authors who have written textbooks of **philosophy** and to tell me which are the most commonly used, and whether they have any new ones since twenty years ago. I only remember some of the **Conimbricenses**, Toletus and Rubius” (AT III 185, CSMK 153–54).

If we compare Rubius’s 1611 *Physics* commentary to those of Toletus and the Coimbrans, it stands out as having the freest format. It is divided into treatises and questions, with each treatise only briefly summarizing standard Aristotelian accounts of important concepts in Aristotle’s *Physics*. The questions, by contrast, are much longer and focus on select issues and opposing views (Hattab 1998, 30). This reflects a trend, starting in the seventeenth century, away from standard commentaries toward treatises that dispense with detailed expositions of Aristotle’s text and instead address important questions. Rubius also diverged from tradition on substantive issues. Like **Francisco Suárez**, he denied the real distinction between **essence** and **existence** and affirmed that matter was partially subsistent, arguing that it existed by nature as really distinct from form (Robles 2003, 399). Along with

Suárez, Rubius represents a form of late **Scholasticism** that begins to approach key tenets of Cartesian **metaphysics**.

See also Conimbricenses; Distinction (Real, Modal, and Rational); Jesuit; Scholasticism; Suárez, Francisco; Toletus, Franciscus

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HELEN HATTAB

RULES FOR THE DIRECTION OF THE MIND

The incomplete and posthumously published *Regulae ad directionem ingenii* is one of Descartes' earliest major writings and was included in the posthumous inventory of his effects (under item *F*). It was first published in a Dutch translation in 1684 (version *N*). In 1670 **Leibniz** obtained a copy of the Latin manuscript in Paris (version *H*). The Latin text was first published in *Opuscula posthuma* (1701, the "standard" version, known as *A*). Some passages also appeared in French translation in the *Port-Royal Logic* of **Arnauld** and Nicole (1662) and in **Baillet's** *Vie de Descartes* (1691). A previously unknown copy of an apparently earlier version was discovered in Cambridge University Library in 2011 (version *C*).

The title is appropriate but likely the invention of editors. In English it is typically called *Rules for the Direction of the Mind*, but better alternatives for *ingenium* have been proposed, like "spirit," "**native intelligence**," or "total mind-body equipment." The work is about the proper **method** of knowing and the guidance of the **mind** in thinking and discovery. It was planned to be in three parts, each consisting of twelve rule-rubrics plus elaboration, but only the first twenty-one rubrics exist (the last three without elaboration).

The first part treats problem solving (*quaestiones*) in general. Rule 3 attributes all knowing to two human powers (intuition and **deduction**, the latter derivative of the former, without a sharp boundary dividing the two). They must be used methodically and employ a fundamental kind of **mathematics**, called *mathesis universalis* in the second half of Rule 4, to break down what is complicated into what is simple (Rule 5). Order and measure must be established among all things apprehended by

the mind by “proportionalizing” the degree to which the things being considered contain or participate in natures and, ultimately, in **simple natures** (Rule 6; the simple natures are further discussed in Rules 8 and 12). Rule 7 emphasizes that the completion of **knowledge** requires that “every single thing ... must be surveyed in a continuous and wholly uninterrupted sweep of thought” (or **imagination**). It also introduces the operation of **enumeration** (also called induction) to assure that solutions are complete and distinct, especially when we “infer a proposition from many disconnected propositions.” It may be performed either completely or merely sufficiently – for example, the latter when we can readily assign the matters in question to conveniently chosen classes. Rule 8 argues that where intuition stops, we must discontinue our inquiry, and it gives examples of how to use enumeration to address problems about **light** refraction and the nature and scope of human knowledge. Rule 11 complicates the relationship between intuition, deduction, and enumeration: when deduction occurs in a simple and transparent way, it is “made through intuition,” but when it is complex and involved we “call it ‘enumeration’ or ‘induction.’” The first half of Rule 12 explains how **intellect** is constantly aided by sense **perception**, imagination, and **memory** (the second half is devoted to simple natures). *Ingenium* proper is defined as intellect’s consideration and the alteration or production of images, whatever their source (AT X 416, CSM I 42).

The incomplete second set of twelve rules tries to lay the basis for solving “perfectly understood problems” (in which the givens are sufficient to determine a solution) by rigorously employing proportionately representative figures, chiefly line segments and rectangles. Figures and symbols are to be used to stand for the proportional relations between the elements of the problem analyzed in light of the natures, and geometrical transformations of the figures and corresponding algebraic manipulations of symbolized equations are interactively applied to solve for unknowns, which are likewise represented by figures and symbols. Thus, the figures and equations stand less for things than for proportions. The rules actually explaining how to use the lines and figures to represent arithmetic operations break off almost as soon as they begin; thus they take no more than a few steps toward the concerns of the 1637 *Geometry*, which solves problems by the continuous evolution of curves rather than by steps linking intuition to intuition in a longer, possibly enumerative deduction. The last twelve rules (planned but never completed) were to address problems in which the givens are inadequate for determining a solution.

The leading debates about the *Rules* concern the period of composition, its consistency, and how much its theory of method and mathematics anticipates the *Discourse on Method* and the *Geometry*. Although Descartes seems to have abandoned work on it circa 1628–29, there is disagreement about when he began. Most scholars have attributed composition to the later 1620s. Weber argued that inconsistencies prove it was composed in stages, beginning in late 1619. Marion and others

have countered that the inconsistencies are an artifact of Weber's interpretation; Descartes probably abandoned it because he had encountered problems of ontology and epistemology (e.g., with the simple natures) that were superseded by the new **metaphysics** and mechanical science he began circa 1629. The recent discovery by Richard Serjeantson of version *C*, a shorter, apparently earlier version of the *Rules*, provides new evidence for the sequence and timing of Descartes' concerns: in particular, the material on simple natures, *mathesis universalis*, and the separation of **body** and intellect is absent.

The chief questions about mathematical and scientific method concern more the degree than the fact of consonance between the *Rules* and the *Discourse* (and its accompanying scientific essays). The latter, no longer highlighting *mathesis universalis* and the imaginative representation of problem proportions using figures and symbols, nevertheless constantly applies some of the former's strategies. The importance of the psychological theory sketched by Rules 8 and 12 to Descartes' later method and mathematics still remains to be appreciated.

See also Deduction, *Discourse on Method*, Enumeration, *Geometry*, Intellect, Knowledge, Mathematics, *Mathesis Universalis*, Method, Native Intelligence, Simple Nature

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DENNIS L. SEPPER

SCHOLASTICISM

One of Descartes' central aims is to substitute his own views for those of the Scholastics. At the same time, Descartes also owes significant debts to the Scholastics, who were a powerful force during his time and whose teachings were fundamental to his **Jesuit** education at La Flèche. So relating his thought to Scholasticism is important for understanding his targets as well as for interpreting the ideas he inherited from his predecessors.

Central to Scholasticism were the teachings of Aristotle, whom Descartes singles out as a target of his *Meditations*: "These six Meditations contain all the foundations of my **physics**. But please do not tell people, for that might make it harder for supporters of Aristotle to approve them. I hope that readers will gradually get used to my principles, and recognize their **truth**, before they notice that they destroy the principles of Aristotle" (AT III 298, CSMK 173). He criticizes those who rely on Aristotle rather than **reason** (AT III 432, 796; CSMK 195, 215) and repeatedly expresses frustration with the strong influence of Aristotle (AT I 522, CSMK 79; AT III 349, CSMK 177). He describes the views of the Scholastics as mostly doubtful as well as useless for the purposes of **explanation** (AT VIIIB 26, CSMK 221). In 1640 he conceives of a plan to publish a work that would include **Eustachius a Sancto Paulo's** *Summa philosophica quadripartita*, with his own views juxtaposed (AT III 523, CSMK 209–10), a plan he never carries out.

At the same time, Descartes sometimes notes agreements with Aristotle (AT IV 141, 157; CSMK 238, 240). Given his criticisms of Aristotle elsewhere, his doing so is likely motivated by prudence. He expresses a sense of intellectual indebtedness to the Jesuits and recommends a Jesuit education in **philosophy**, in particular, La Flèche (AT II 378). But he also indicates that he felt it was in his interest to be on good terms with the Jesuits (AT IV 157, CSMK 240). His strategy is often to offer his own views while remaining silent about Scholastic views in the hope that his own views will be accepted instead of those of the Scholastics, as we saw him indicate in regard to Aristotle. For instance, while in letters he is often very critical of the notions of **real quality** and **substantial form**, he avoids discussing them in his published works.

How well did Descartes know Aristotelian Scholasticism or specific thinkers in that tradition? Which ones are particularly relevant to understanding his thought? His training at La Flèche would have given him significant exposure to **Saint Thomas Aquinas** who was central to the teachings of the Jesuits and thus emerges as perhaps particularly relevant to Descartes (Carriero 2009). Aquinas was the focus of Étienne Gilson's important work (1930) on the relationship of Descartes to the Scholastics during the early and mid-twentieth century. A particularly useful contribution is his *Index scolastico-cartésien*, which collects quotes from Aquinas as well as several late Scholastics on a wide range of topics and notions that occur on Descartes' work.

But close examination of Descartes' views reveals the crucial importance of other Scholastics. Paul Hoffman (1986) has addressed the question whether Descartes is a hylomorphist, who conceives of the **human being** as a single **substance** in virtue of the soul being the substantial form of the **body**. Hoffman showed that the issue looks quite different when one considers the thought of **Scotus** and **Ockham**, instead of limiting oneself to Aquinas. Indeed, Scotus wielded significant influence in Descartes' time (Ariew 2011, 71–100). Furthermore, given that several centuries lapsed since these high Scholastics, consideration of Scholastics who were active close to, or during, Descartes' time is of obvious significance. Descartes mentions the **Conimbricenses**, Jesuits connected to the University in Coimbra, Portugal, who wrote commentaries on Aristotle at the end of the sixteenth century that were widely read in the early seventeenth century, as well as **Toletus** and **Rubius** (AT III 190, CSMK 154). He refers also to **Francisco Suárez** (AT VII 235, CSM II 235), who was very influential in the period and is very helpful because he systematically discusses a variety of opinions on any issue. Descartes writes in 1640 that he has not read any of the writings of the Jesuits in twenty years, and he expresses an interest in a summary of “the whole of Scholastic philosophy,” which he finds in Eustachius a Sancto Paulo's *Summa philosophica quadripartita* (AT III 185, CSMK 153–54). He also plans to read Abra de Raconis (AT III 234).

Descartes indicates that the distinctions among the Scholastics do not matter to him: “I do not think that the diversity of the opinions of the Scholastics makes their philosophy difficult to refute. It is easy to overturn the foundation on which they all agree, and once that has been done, all their disagreements over details will seem foolish” (AT III 231, CSMK 156). This suggests that he simply overthrows all of Scholastic thought. It is true that he rejects important ideas that were fundamental or widely accepted among the Scholastics. He rejects their empiricism, the Aristotelian view that the **mind** at birth is a *tabula rasa*, expressed by the dictum “Nothing is in the intellect unless it has been in the senses”: an important aim of the *Meditations* is to lead the mind away from the senses and toward innate **ideas** that Descartes believes are implanted by **God** in the mind. A major departure consists in his view that **explanation** in the physical world is entirely mechanistic and appeals only to **shape**, size, **motion**, position, and **extension**. Secondary qualities as they appear to us do not exist in the physical world (see **quality**, **sensible**). He reconceptualizes the notion of the human soul as identical to the mind, which he saw as the principle of **thought** (AT VII 356, CSM II 246). Within Aristotelianism, the mind was the intellectual part of the soul, which was the principle of life. This change involves moving **sensation**, **imagination**, and feelings out of the ensouled body into the mind and classifying them under his broad term “thought” – what we now call “mental states.” Everything else that soul used to explain is now accounted for mechanistically. He rejects the notion of substantial form, with the (complicated) exception of the human soul or mind. He criticizes as contradictory the widely accepted

Scholastic notion of what he calls a “real quality,” a quality that can exist without the substance to which it belongs, which means that he rejects standard Scholastic explanations of **transubstantiation**.

But careful study of Descartes’ thought suggests other connections with Scholasticism as well. Descartes accepts various Scholastic doctrines, such as the theory of distinctions and Scotus’s notion of objective being (Dalbiez 1929; Wells 1967, 1990; also see Cronin 1966, which contains extensive quotes from Scotus) (see **distinction [real, modal, and rational]** and **being, formal versus objective**). Sometimes Descartes’ position consists in taking sides *within* a Scholastic debate: on the question whether there is more than one soul in a human being as many Scholastics had held – a rational, a sensitive, and a vegetative soul (AT III 369, 371; CSMK 181, 182); whether there is a real distinction between **essence** and **existence** (AT IV 349–50, CSMK 280); and the notion of objective being, where he agrees with Scotus rather than Ockham (Renault 2000). While the Scholastics were not dualists, they did hold that the **intellect** operates without use of a corporeal organ, and often relied on this idea to argue that the rational soul can exist without the body (Rozemond 1998, ch. 1). Consequently, Descartes’ well-known problem of mind-body interaction, especially as it arises in sense **perception**, has a precedent in the Scholastics, who struggled with the role of the imagination, which they saw as corporeal, in the production of intellectual species in the immaterial mind. The issues are not exactly the same, but Descartes’ use of the term “occasion” resonates with Scholastic uses of that term (Schepers 1966, Rozemond 1999).

Furthermore, Scholasticism contained significant Platonistic influences, and the tenets of Christianity, as interpreted by the Catholic Church, were central for Christian Scholastics. Consequently, if Descartes uses a particular idea that also occurs within Scholasticism, this is not necessarily a sign of an Aristotelian element in Descartes. Thus, he uses the idea that the soul is whole in the whole and whole in the parts (see **holenmerism**), which can be found within Scholasticism, but it is not an Aristotelian idea and can also be found in **Augustine** and Plotinus. Descartes’ use of notions he inherits requires close examination, as is illustrated by the notion of substantial form. Descartes writes that the human soul is the only substantial form. But he connects this idea to the soul’s status as an incorruptible spiritual substance, which strains against its status as a genuine substantial form in the original Aristotelian sense of an entity that is inherently an inseparable constituent of a composite substance.

It is difficult to establish specific connections with individual Scholastics. For illuminating Descartes’ thought, however, this is not always necessary, since relevant views were often widely accepted or present in more than one Scholastic. Thus, Scotus likely influenced Descartes indirectly by way of his impact on late Scholasticism. Finally, Scholasticism is not the only type of thought relevant for understanding Descartes. Atomism is an important target for Descartes (see **atom**, **vacuum**) (Garber 1986, 117–55; Ariew 2011, 157–77; Rozemond 1998, 90–99).

Hattab (2009) argues that the Dutch atomist Gorleaus offered a substance-mode ontology before Descartes did. And many thinkers in the period combined ideas from various origins (Ariew 2011).

See also Aquinas, Thomas; Augustine; Being, Formal versus Objective; Distinction (Real, Modal, and Rational); Eustachius a Sancto Paulo; Explanation; Fonseca, Pedro da; Form, Substantial; Holenmerism; Human Being; Idea; Jesuit; Mechanics; Quality, Real; Rubius, Antonius; Scotus, John Duns; Soul, Immortality of the; Suárez, Francisco; Substance; Toletus, Franciscus; Transubstantiation

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SCHOOCK, MARTINUS (1614–1669)

Born at Utrecht, Martin Schoock studied Law at Franeker, possibly **philosophy** and theology at Leiden and in any case philosophy at Utrecht, where he was the first to take a degree (1636), his supervisor being Descartes' friend **Henricus Reneri**. In 1638 he was appointed "professor extraordinary" (i.e., reader or associate professor) in the humanities at Utrecht, but the same year moved to Deventer to become professor of history and eloquence. In 1640 he became professor of logic and **physics** at Groningen. In 1666, finally, plagued by financial problems and a deserved reputation of alcoholism, he fled to Frankfurt on the Oder to become professor of history.

Schoock was a prolific author, who wrote on a wide range of subjects, varying from the history of the Dutch revolt and the struggle against the sea to the fabrication of butter and beer and the production of peat – not to mention his numerous polemical works. From his early days, he must have been a protégé of **Gysbertus Voetius** for whom he wrote against the Remonstrants and the Catholics even before he was appointed at Utrecht. Even so, he must initially have kept an open eye for the career possibilities of the new philosophy. In his dissertation, *On the Nature of Sound and the Echo*, which he reworked into a more elaborate treatise, he announces a new era for philosophy. However, in 1642, after the publication of the *Letter to Dinet*, he was dragged into Descartes' conflict with Voetius. The result was *Admiranda methodus* (1643). Written in a difficult Latin and crammed with classical allusions the book contains some serious accusations, in particular, that Descartes is a second **Vanini**, who in 1619 was burned at the stake. What one finds in Descartes would be a particular brand of atheism ("subtle atheism"), which consists in presenting usually weak arguments for the **existence** of **God**, while doing everything to undermine religion. Schoock dissociated himself from this part of his work, implicitly claiming that it came from Voetius. He also criticized the way Descartes spoke of books and learning and condemned Descartes' criterion of evidence as encouraging private fantasies: all the student had to do, according to him, was to forget the evidence of his eyes and the arguments of others and believe whatever Descartes pontificated. Even though Schoock's critique is eccentrically formulated, on a deeper level it probably reflects the uneasiness of many philosophers at the time who saw philosophy as the essentially historical and social process of slowly and gradually recovering the **truth** about nature. His critique is motivated moreover by the typically Calvinist distrust of individual **reason**; in his view reason is a very weak but also a very seductive instrument which, unless it is subordinated to the evidence of the senses and the laws of dialectic (not to mention the superior evidence of Revelation), inevitably becomes the slave of the **imagination** and the **passions**.

See also Dinet, Jacques; God; Reason; Reneri, Henricus; Vanini, Giulio Cesare; Voetius, Gysbertus

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THEO VERBEEK

SCOTUS, JOHN DUNS (1265?–1308)

Scotus was probably born in Scotland around 1265. He was ordained as a priest in Northampton (England) and became one of the most important theologians of the late Middle Ages. He lectured on Peter Lombard's *Sentences* twice in Paris (1302 and 1304) and in Oxford and was named *Doctor Subtilis* (the Subtle Doctor) for his penetrating manner of thought. He was dispatched, likely in October 1307, to the Franciscan *studium* at Cologne, where he died.

Although Duns Scotus's texts became accessible after 1639, it is unlikely that Descartes was acquainted with them. Indeed, Descartes had studied at the **Jesuit** Collège de La Flèche, where **Thomas Aquinas** was the acknowledged authority. However, Descartes indirectly knew Scotus, because he studied the texts of **Francisco Suárez**, who often cited Scotus's views, and especially because Suárez himself had been deeply influenced by Scotus's **philosophy**, as had been **Eustachius a Sancto Paulo**, with whose *Summa philosophica* Descartes was acquainted.

Descartes cites Scotus only once, in replying to **Caterus**. There, he refuses to accept a "formal" distinction, as Scotus suggested, not reducible to a "modal" one (AT VII 120, CSM II 85–86) (see **distinction [real, modal, and rational]**). Notwithstanding the absence of direct references, Scotus's influence on Descartes' philosophy surfaces even in the terms used in the latter. Attributing **clarity and distinctness** to the **mind's** cognitions has its ancestry in Scotus (and even earlier in the Stoics). According to Scotus, clear **knowledge** requires that the object be present to the mind, and distinct knowledge of a thing is knowledge of its **essence** (*Ordinatio* I, d.3, p.1, q. 1–2; 1950, 3:50).

The following Scotistic doctrines play a key role in Descartes' philosophy.

1. THE DOCTRINE OF OBJECTIVE BEING (*ESSE OBJECTIVUM*)

Scotus deeply modified Aquinas's views concerning the knowledge that **God** has of what can be created. According to Aquinas, the essences of finite things are the relations between what can be created and the infinite divine essence, and God knows them by knowing his essence. According to Scotus, by contrast, God knows the relation between a thing's essence and his divine essence only after having endowed the thing's essence with an *esse intelligibile* (intelligible being). The thing's *esse intelligibile* is the object of divine knowing (its *esse obiectivum*), which Duns Scotus distinguishes from the formal side of divine thought – the act of thinking (see **being, formal versus objective**). A thing's *esse obiectivum*, as a consequence, turns out to be independent from the knowledge of the divine essence. Moreover, the *esse obiectivum* of the essences of finite things is endowed with a kind of reality inferior to that of existing things but superior to that of beings of reason. Scotus named this kind of reality *esse diminutum* (diminutive being) and deemed it to be the condition for them to be the object of divine **thought**.

Notwithstanding its theological origin, the Scotist view of *esse obiectivum* affects the Cartesian theory of human knowledge. Indeed, Descartes attributed objective reality to the object of human **ideas**, distinguishing the objective reality of an idea from its formal reality, as Scotus had done in relation to divine knowledge. Hence, looking for what causes ideas' *esse obiectivum* became legitimate. The thesis that ideas have objective reality grounds Descartes' **Cosmological Argument** for God's **existence**, which looks for the **cause** of the objective reality of the idea of God.

2. ABSTRACTIVE KNOWLEDGE OF GOD

Aquinas flatly denied that the infinite can be known via a finite concept, as there is no similarity relation or ratio between finite and infinite. Thus, God can only be known positively by direct vision, with no conceptual mediation, as the blessed do, or negatively, starting from creatures, as **human beings** do in their earthly life. By contrast, Scotus held that a similarity relation or a ratio between a concept and its object is not required in order to represent the second by means of the first, which allows for **representation** of the infinite by a finite concept. Therefore, it would be possible to have an "abstractive" and positive knowledge of God. Abstractive cognition is knowledge independent of the actual existence of its object, and it is the one the sciences use; in Scotist thought, consequentially, theology belongs in principle to the scientific domain (*Ordinatio* II, d.3, pars 2, q.2; 1950, 7:562–63). Yet the human mind, made feeble by the sin, does not have abstractive knowledge of God, which is rather the knowledge of him that **angels** have.

Scotus's view became that of Suárez and Vazquez, and Descartes turns it into the ground of his own philosophical theology, attributing to the human mind the clear and distinct knowledge of God that Scotus held to be proper to angels. More generally, following Suárez and Vasquez, Descartes rejects similarity as a necessary condition for representation.

Moreover, for both Scotus and Descartes, and contrary to Aquinas, positive knowledge comes before negative knowledge, and hence knowledge of the infinite comes before that of the finite (*Ordinatio* I, d.3, pars I, q.1–2; 1950, 3:4). Finally, in Scotus knowledge of the infinite may be clear without a comprehension of the infinite, as later Descartes argued (*Ordinatio* II, d.3, pars II, q.2; 1950, 7:562–63).

On the preceding grounds, Scotus believed that an **ontological argument** for God's existence was possible in principle. Indeed, God's essence, defined by a concept, can be assumed as a premise in the proof. Again, Descartes follows Scotus, attributing to the human mind the clear and distinct idea of God and using this idea as the foundation for his version of the ontological argument.

See also Angel; Aquinas, Thomas; Being, Formal versus Objective; Clarity and Distinctness; Cosmological Argument; Distinction (Real, Modal, and Rational); Essence; Existence; God; Idea; Infinite versus Indefinite; Knowledge; Ontological Argument; Representation; Suárez, Francisco; Thought

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SEARCH FOR TRUTH BY THE NATURAL LIGHT

La recherche de la vérité par la lumière naturelle is the title given to a dialogue among three people, Poliander, Epistemon, and Eudoxe, in which Poliander represents the views of a gentleman of good breeding but without any formal education in **philosophy**; Epistemon, the position of a traditional philosopher who has read extensively in philosophical literature; and Eudoxe, the position of a Cartesian, who relies on his own intelligence. The intention is to show that, as long as one uses one's common sense, it is not difficult to choose between the traditional approach to philosophy, which relies on reading, **memory**, and authority, and the Cartesian approach, which relies on one's own intelligence. The dialogue form, which is unique in Descartes' work, could be an experiment in style or an imitation of **Galileo**. However, the underlying technique of confronting the two approaches and leaving it to the common reader to decide is, to a certain extent, familiar from Descartes' other works, like the planned but never realized sequel to the *Discourse on Method* (1637), the *Objections and Replies* that accompany the *Meditations* (1641), and even the *Principles of Philosophy* (1644).

Unfortunately, the *Search for Truth* was left unfinished. And although it was clearly meant as a complete exposition of Descartes' philosophy (AT X 505–6), the text hardly reaches beyond the first stage – namely, the decision to call everything into **doubt** and the *cogito*. In that sense, the work does not add much to the *Discourse* and the *Meditations*. However, that makes it even more frustrating that we do not know when Descartes wrote it. Some place it at the beginning of Descartes' career, even before 1631 (Carraud and Olivo 2013); others, somewhere in the middle, suggesting that it may have been written for **Constantijn Huygens** (see Alquié 1973, II, 1101–4), whereas others place it at the end of his career, in the belief that it was written for **Queen Christina** (Cassirer 1942). This much is clear: like the *Discourse on Method* (1637) and the *Passions of the Soul* (1649) the dialogue was written for a nonacademic audience, whereas the *Meditations* and the *Principles* are meant for specialists. That must also have been the reason why it was written in French. The editorial fate of the *Search* was closely connected with that of the *Rules for the Direction of the Mind*. Both were first published in a Dutch translation in 1684. In both cases, the published text goes back to a copy made by Ehrenfried Walter von Tschirnhaus (1651–1708) of the autograph in the possession of **Claude Clerselier**. Both were also published in a Latin version in 1701 as part of Descartes' *Opera posthuma*. All we have for the original French text of the *Search for Truth* is an incomplete copy in the Leibniz Archives (Hanover), which equally goes back to Tschirnhaus.

See also Discourse on Method, Meditations on First Philosophy

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THEO VERBEEK AND ERIK-JAN BOS

SENSATION

In Descartes' corpus, the term "sensation" (from the Latin *sentire*) always concerns *sense perception* (cf. AT VIIIA 316; CSM I 280). (Indeed, it refers to *human* sense perception; this clearly raises issues concerning sense perception in nonhuman **animals**, treatment of which is beyond the scope of this article.) This point bears emphasis because many Anglo-American philosophers today make a distinction *between* sensation and sense perception; in fact, what these philosophers refer to as sensations (e.g., pain, hunger, thirst) will for Descartes be connected to what he calls the *internal* senses (AT VIIIA 316–18, CSM I 280–81; the internal senses are seldom thematized in the Descartes literature: see Baker and Morris 1996, esp. 124ff.). The internal senses, as we will see, have a special role vis-à-vis the mind-body union and, because of this, a special role vis-à-vis Descartes' claim that sensations are *confused modes* of thinking.

1. INTERNAL AND EXTERNAL SENSES

The internal senses are part of the traditional Scholastic package of functions of the sensitive soul (although Descartes' characterizations differed from those of his predecessors), functions that Descartes sought to explain mechanically – that is, without a soul (see **dualism** and **perception**). The internal senses are distinguished from the external

ones in virtue of the fact that their “objects” are, in some sense, properties of *the perceiver’s body* rather than (in some sense) properties of things outside the body. Descartes identified two internal senses, connected with the natural appetites and the emotions respectively (AT VIII 316, CSM I 280; the present entry concentrates on the first internal sense, that associated with the natural appetites; see **passions** for a treatment of the second internal sense). The “objects” of the internal senses (e.g., pain, hunger, thirst, fear, anger, joy) are intrinsically connected with bodily health or welfare. To be sure, the “proper purpose” of *all* sensory perceptions is “simply to inform the **mind** of what is beneficial or harmful for the composite of which the mind is a part” (AT VII 83, CSM II 57; Simmons [2001] stresses that this is a *teleological* account of sensory perception and defends Descartes against the charge of inconsistency with what is widely seen as his opposition to teleological **explanation**). The internal senses, however, have a certain priority over the external ones: the colorful stripes of the wasp that I perceive by sight inform me of potential harm only because they are associated with the pain of its sting, perceived by an internal sense; the smell of rotting meat informs me of danger only because it is associated with nausea, likewise perceived by an internal sense.

The internal senses play a pivotal role in the arguments of the Sixth Meditation. They are seen as especially central to the teachings of “**nature**” (“the totality of things bestowed on me by God”): first, nature teaches me “that I have a body, and that when I feel pain there is something wrong with the body, and that when I am hungry or thirsty the body needs food and drink, and so on”; second, nature teaches me “by these sensations of pain, hunger, thirst and so on, that I am not merely present in my body as a sailor is present in a ship, but that ... I and the body form a unit” (AT VII 80–81, CSM II 56). The combination of the first teaching of nature with the possibility of deception by the internal senses (e.g., AT VII 76, CSM II 53: the pain felt in the missing part of the body by those who have had a limb amputated) raises a version of the problem of error going beyond that already dealt with in the Fourth Meditation. Descartes pursues this in connection both with the case of “phantom pain” and with a second instance: dropsy. A dropsical body will be disposed by its nature to take a drink, “with the result that the disease will be aggravated” (AT VII 84; CSM II 58), which implies that the sensation of thirst, instead of performing its proper function of helping to maintain the welfare of the body, actually does the opposite (see **human being**). (That our God-given nature should positively mislead us requires a second theodicy, which occupies much of the second half of the Sixth Meditation; see **error, theodicies of**.)

2. SENSATIONS AS “CONFUSED THOUGHTS”

Descartes notoriously distinguishes between “three grades of sensory response.” The first grade consists in “the immediate stimulation of the bodily organs by external

objects”; the second “comprises all the immediate effects produced in the mind as a result of its being united with a bodily organ which is affected in this way” (including “the perception of pain, pleasure, thirst, hunger, colours, sound ...”); the third “includes all the **judgements** about things outside us which we have been accustomed to make from our earliest years – judgements which are occasioned by the movements of these bodily organs” (AT VII 43–47, CSM II 294–95). What Descartes calls “sensations,” as they have to do with *human* sense perception, are not to be identified with the first grade (which animals too possess); I urge that they compose the second grade (although the third grade plays a role in our understanding of the sense in which sensations are *confused thoughts*). I take it for granted, since for Descartes the **essence** of the mind is thought, that sensations are *thoughts*. (It may be argued that those who find this problematic are being misled by the modern use of the term “sensation” alluded to earlier; see also **dualism**.) This still leaves some questions unanswered.

Both sense perception and **imagination** are “faculties for special modes of thinking” (AT VII 78, CSM II 54; their “specialness” stems from the fact that only minds united with bodies possess these **faculties**); the thoughts for which sense perception is a faculty are what Descartes calls sensations. Sensations, moreover, are *confused* thoughts. What is meant by confused here? However we interpret it, the term must be understood as the contrary of “distinct” (see **clarity and distinctness**). A robust interpretation might take off from the idea that a distinct thought is one that is perceived distinctly, that is, *distinguished* from others with which it is liable to be confused, with confusion therefore entailing a failure to distinguish (see Morris 1995, Nelson 1997).

There are two types of confusion: one due to our bad **habits** of thinking acquired in childhood (“judgements ... which we have been accustomed to make from our earliest years”), the other (also corrigible) due to our nature as union of mind and body. Both the sensations associated with the external senses and those associated with the internal senses are often “confused” in the first way; those associated with the internal senses may be confused in the second way, because of their unique role within the mind-body union.

3. HABITUAL CONFUSION

Descartes distinguishes seven senses; these correspond to seven different sets of nerves, and there are correspondingly multiple “kinds of objects stimulating the sensory nerves” and “kinds of confused thoughts which the resulting **motions** produce in the soul” (AT VIIIA 318, CSM I 281). Thus, for example, the extremities of the optic nerves are moved by “globules of the second **element** <which pass through the pores and all the fluids and transparent membranes of the eye>.”

This movement is then transmitted to the **pineal gland**, and “this is the origin of the sensations of light and colours” (AT VIIIA 319, CSM I 283). A different but parallel story will be told for the other senses. Crucially for Descartes, it follows that “the mere occurrence of certain motions in the body can stimulate [the mind] to have all manner of thoughts which have no likeness to the movements in question” (AT VIIIA 320, CSM I 284) – for example, the color red, as the idea of it occurs in our sensation of red, has no *resemblance* to those globules of the second element, nor to whatever it was in the world that caused those globules to impact on the optic nerves, nor to the movements of the extremities of the optic nerve, nor to the motions in the brain. Likewise, if I am struck by a sword, “the ensuing pain is completely different from the local motion of the sword or of the body that is cut” (AT VIIIA 321, CSM I 284).

This underlies the **explanation** of the earlier insistence on keeping “objects” in quotation marks, and qualifying “properties” with “in a sense.” A sensation of red (or a sensation of pain) is a thought *about* red (or pain) (not everyone agrees; see, e.g., MacKenzie 1989). The issue is the sense in which it is a thought *about* a property of an external physical object; we know that the only real properties of physical objects that Descartes allows are mechanical properties (**modes of extension**) (there is a vast literature on this debate; see, e.g., Simmons 1999). It seems to me that, in one sense, a thought about red is a thought *about* a mode of extension; in another sense, it is not. It may be said to be a thought “about” a mode of extension (whatever it is about the world that causes the globules of the second element to impact upon my optic nerves) that is picked out by (thus “corresponds to”) our idea of red; but that idea *represents* that mode of extension not as a mode of extension but as a color (which bears no resemblance to any such mode of extension).

In observing that a perception may be clear without being distinct, Descartes uses the example of the perception of pain (i.e., the sensation of pain), which, while “very clear,” is “not always distinct. For people commonly confuse this perception with an obscure judgment they make concerning the nature of something which they think exists in the painful spot and which they suppose to resemble the sensation of pain” (AT VIIIA 22; CSM I 208; Nelson 1997, 167, calls attention to the word “commonly,” which reminds us that confusion is something that *we do* and can refrain from doing). The reference to *judgment* here indicates that the third “grade” of sensory response is in play; and the judgment in question involves judging that there is something at the painful spot that “resembles” the idea of pain, which figures in the sensation of pain, which judgment, as we have just seen, is false.

What exactly is the confusion (failure to distinguish) here, though? Surely it is, precisely, a confusion between *correspondence* and *resemblance*: when we have a sensation, we are justified in inferring that “the bodies which are the source of these

various sensory perceptions possess differences corresponding to them” (fortunately for us – i.e., for our welfare), but *not* in inferring that these bodies resemble them (AT VII 81, CSM II 56; cf. AT VIIA 34, CSM I 218); yet, owing to our bad youthful habits, we commonly draw that latter inference and hence make the “obscure judgment” to which Descartes refers (cf. Arnauld and Nicole 1996, pt. I ch. 11; cf. Cunning 2010, 181ff.).

4. NATURAL CONFUSION

The internal senses are associated with thoughts whose confusion arises *from* the mind-body union (AT VII 81, CSM II 56). How should we make sense of this? We might note that my nature as union of mind and body involves some kind of normal correlation between specific thoughts and specific conditions of the body and naturally gives rise to specific remedial actions: the sensation of pain in the foot (the thought that my foot hurts) is normally correlated with an injury to my foot, and the thought that my foot is injured induces me to move my foot away from the source of injury; the sensation of thirst (the thought that I am thirsty) is normally correlated with my body’s needing liquid, and the thought that my body needs liquid induces me to drink (cf. AT VII 88, CSM II 61: “When we need drink, there arises a certain dryness in the throat; this sets in motion the nerves of the throat, which in turn move the inner parts of the brain. This motion produces in the mind a sensation of thirst, because the most useful thing for us to know about the whole business is that we need drink in order to stay healthy”; cf. AT VII 76, CSM II 53).

Now, normally – that is, when the body is whole and not suffering from disease – there is no need to distinguish between the sensation of pain and the thought that my foot is injured (and requires remedial treatment), or between the sensation of thirst and the thought that my body needs liquid (thus that I need to drink). Indeed, normally pausing to make that distinction might actually endanger welfare by slowing our remedial responses. So normally we *do* not distinguish these: thus, the sensation of thirst is naturally apt to be “confused” with this other thought and thus to give rise to the remedial action of drinking. (The second problem of error referred to earlier arises precisely because the thought that my body needs liquid with which the sensation of thirst is naturally confused may be false when the body is diseased, and thus the sensation of thirst may lead me into action that is not only not remedial but harmful.) This amounts to something like what Simmons (1999, 355) calls a “bio-functional account of sensory representation” in respect of the sensations associated with the internal senses: these sensations “conduce to self-preservation” by representing the body, not in itself “as conceived by the Cartesian physicist,” but relative to the body’s well-being. She offers this as an account of “sensory **representation**,” which applies to the external senses as well; but one might suggest that

because of the welfare-related priority of the internal senses referred to earlier, it applies primarily to the internal senses.

See also Anatomy and Physiology; Clarity and Distinctness; Common Sense; Error, Theodicies of; Faculty; Habit; Human Being; Imagination; Memory; Optics; Perception; Pineal Gland; Representation; Thought

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SHAPE

From quite early in his career, Descartes lists shape as one of the three genuine "modes" of **extension** or ways of being extended, the other two being size and **motion**. This austere ontology of **body** is in sharp contrast to the Aristotelian Scholastic model of the **explanation** of natural phenomena that appeals to an elaborate scheme of forms and qualities. As a proponent of mechanistic scientific explanations, Descartes held instead that all natural phenomena can be explained entirely

in terms of the arrangements of corpuscles, or extended microbodies, characterized solely in terms of size, shape, and motion.

Although motion plays a central role in Descartes' natural philosophy, shape is no less important to his scheme of scientific explanation. This is because the way that motion is characterized seems to presuppose that body has a determinate extension or shape. According to the "proper" characterization of motion Descartes introduces in the *Principles*, it consists in "the transfer of one piece of matter, or one body, from the vicinity of the other bodies which are in immediate contact with it, and which are regarded as being at rest, to the vicinity of other bodies" (AT VIII A 53, CSM I 233). Yet this account presupposes the **individuation** of bodies from one another, which in turn seems to presuppose that a body, insofar as it is delineated from the bodies that surround it, has at any particular moment a determinate extension or shape. Further evidence for the explanatory importance of the mode of shape can be found in Descartes' insistence in his early work, the *Rules*, that shape plays a central role in all cases of sense **perception**: "Sense perception occurs in the same way in which **wax** takes on an impression from a seal. It should not be thought that I have a mere **analogy** in mind here" (AT X 412–13, CSM I 40–41).

As obvious as the idea that shape is a modification of extension might seem, there are deep interpretative and philosophical difficulties with Descartes' claim. The principle interpretative difficulty is that it is not clear what he means by "shape," a difficulty that is exacerbated by the fact that he never offers an explicit explanation. In the *Rules*, he says that shape, extension, motion, and other purely material corporeal "natures" are "simple" in the sense that "they cannot be divided by the **mind** into other things more distinctly known" (AT X 418, CSM I 44) (see **simple nature**). Indeed, he says, "the concept of shape is so simple and common that it is involved in everything perceivable by the senses" (CSM I 40, AT X 413). These claims might seem to constitute an explanation of why Descartes does not think the notion of shape can be defined or explained: it is simply primitive or unanalyzable. However, this does not prevent Descartes in later works from explaining what he means by "motion," and we might wish he had taken similar care with the notion of shape. There are nevertheless some hints in the *Rules* about how Descartes understands the mode of shape. In the context of a discussion of the type of **abstraction** used in forming the proper conception of the corporeal natures, Descartes says:

When we are concerned with a figure, we should bear in mind that we are dealing with an extended subject, conceived simply with respect to its having a shape. When we are concerned with a body, we should bear in mind that it is the same thing we are dealing with, in that it is something that has length, breadth and depth. In the case of a surface, we should conceive of the same thing, as being something with length and breadth – this time leaving out depth, though not denying it. (AT X 446, CSM I 61)

There are two significant claims in this text. The first is that the shape of a body just is the body itself considered with respect to its having a determinate spatial extension in length, breadth, and depth. It is indeed hard to know how to put this latter point more simply, but perhaps the idea could be expressed by saying that a shape is the body itself considered with respect to the particular spatial relations among its parts. Of course, in a **plenum physics** of the sort endorsed by Descartes, no object will retain its shape for longer than a moment; nevertheless, if bodies in a plenum can be metaphysically individuated from one another, any particular body will at any moment have parts that bear determinate spatial relations to one another – and that is what it means to say that a body has a shape. When a piece of wax, for example, undergoes a change in its shape, it undergoes a change in the relations among its parts.

The second significant claim Descartes makes in the text is that the shape of an object is something distinct from the surface of the object, a mode that Descartes characterizes as “the limit of a body” (AT X 445, CSM I 60). This is important because it might seem *prima facie* plausible to identify shape with the limiting surface of an object. In fact, there is some evidence that **Leibniz** interprets Descartes in this way (Gerhardt 1875–90, 2:119 [Mason 1985, 152]). However, there is good reason to think that Descartes does not wish to identify the notion of shape with the notion of a limiting surface. Besides the text quoted already in which he denies that the shape of a body is to be identified with its surface, there are some texts in which Descartes make some surprising claims about surfaces – claims he does not make about shape. In the Sixth Replies, for example, he seems to endorse the idea that, although a particular surface is a mode, it is a mode that can be had by more than one body at the same time. In other words, it appears that Descartes thinks of surfaces as “straddling modes”:

I did not deny that the surface is the boundary of a body; on the contrary it can quite properly be called the boundary of the contained body as much as the containing one, in the sense in which bodies are said to be contiguous when their boundaries are together. For when two bodies are in mutual contact there is a single common boundary common to both which is part of neither; it is the same mode of each body. (AT VII 433, CSM II 292; see Hoffman 1990)

As he confirms in a 1645 letter to **Mesland**, there is only a distinction “in relation of our thought” between the surface of a body, the surface of the containing body, and the surface intermediate between the contained and containing body: “These three surfaces are in fact a single thing” (AT IV 164, CSM 241–42; cf. AT VII 250–51, 417, 433–34, CSM II 174–75, 281, 292; and AT IV 187, CSMK 248). These claims

are quite challenging from the standpoint of understanding Descartes' ontology. However, for our purposes it is sufficient to note these remarks suggest that it would be a mistake to interpret the Cartesian notion of shape as a limiting boundary. Descartes never suggests that the shape of a particular object is something that could be shared by other bodies, since the shape *just is* that particular body regarded as having a particular length, breadth, and depth.

Descartes' view that shape is a genuine mode of body was the target of repeated criticism by **Leibniz** (1646–1716) (see, e.g., Couturat 1903, 522 [Ariew and Garber 1989, 34]; Leibniz 1923, iv, 312 [Arthur 2001, 315] and Gerhardt 1875–90, 2:77, 98, 119 [Mason 1985, 95–96, 122–23, 152]). Leibniz's objections are somewhat brief and underdeveloped, which has fostered differing interpretations. On one interpretation, given the infinite complexity of the plenum, any shape we attribute to a body will fail to account for infinitely more complexity that must exist along its surface (Sleigh 1990). On another interpretation, infinite complexity would result in the object's having a surface that could not be described in terms of the resources available to seventeenth-century mathematicians and thus would not count as a "determinate" shape (Levey 2005). There is an alternative interpretation of Leibniz's criticisms, however, that cuts much more deeply into Descartes' **metaphysics** of matter by undermining the coherence of the idea that there could be metaphysically individuated bodies – bodies that have metaphysically determinate extensions or shapes – in an infinitely (or "indefinitely," in Descartes' preferred way of speaking) divided plenum. On this interpretation, the problem Leibniz sees arises from combining a Cartesian view about the individuation of bodies with the thesis that the plenum is infinitely divided and thus essentially fluid. According to Descartes, a body is individuated by motion: one body is "whatever is transferred at a given time, though this may consist of many parts which have different motions relative to each other" (AT VII 53–54, CSM II 233). In fact, in an infinitely divided plenum a body will have infinite parts that have different motions relative to one another, and this will be true of the interior of the body, of the surface of the body, and of everything outside the body. Another way to put this is to say that all bodies are to a certain extent fluid, and so, no matter how solid or coherent a body might seem, it must be permeated with more fluid matter, both in its interior and along its surface. The point Leibniz wants to make, then, is that if there are determinate shapes and surfaces, there must be a fact of the matter about which of these fluids that permeate the coarser parts are parts of the body and which are not. But it is not clear what could serve as the grounds of this fact if individuation is grounded in motion (Crockett 2005, 2009).

See also Body; Extension; Individuation; Leibniz, Gottfried Wilhelm; Motion; Place, External versus Internal; Plenum; Quantity; Substance

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TIMOTHY CROCKETT

SILHON, JEAN DE (1596–1667)

Born 1596 at Sos, Silhon was secretary to Cardinal Richelieu (1585–1642) and was appointed by him in 1634 to l'Académie française, established by Louis XIII the following year. He served for many years as a state councilor and was also secretary to Richelieu's successor as chief minister, Cardinal Mazarin (1602–61). He died in Paris, February 1667. Silhon was a close friend of Descartes, though little, if any, of their **correspondence** has survived (see Descartes' letters at AT I 352–54, CSMK 55–56; AT V 134–39, CSMK 330–32, which may have been to Silhon). His two most important works are *Les deux vérités* (1626) and *L'immortalité de l'âme* (1634).

The former begins with arguments against skepticism, for according to Silhon it is only once skepticism has been refuted that **reason** can be reliably employed to prove **God's existence** (the first **truth**), which is itself necessary for the proof that the soul is immortal (the second truth) (see **doubt** and **soul, immortality of**). The latter is of interest for Silhon's argument, directed against the skeptics of his day, that even though a man's senses may deceive him, and even though he cannot know with **certainty** whether he is asleep or awake, nonetheless, when he judges that he exists, he cannot at that moment be mistaken. Thus, there is something he knows to be true (cf. AT VI 31–32, CSM I 127). However, unlike Descartes, for whom the *cogito* is not the result of a **deduction** but stands on its own as a clear and immediate intuition (see AT VI 32, CSM I 127; AT VII 140, CSM II 100), Silhon argues that the certainty attained by his argument rests upon the prior truth that whatever acts must have being. By making "I exist" the conclusion of a deduction, he leaves the door open to the skeptic to **doubt** the premise from which it is said to follow. Descartes mentions no debt to Silhon for his own *cogito* argument, nor does Silhon claim any priority in the matter.

See also Certainty, Clarity and Distinctness, *Cogito Ergo Sum*, Deduction, Mind, Reason, Truth

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FRED ABLONDI

SIMPLE NATURE

The concept of "simple natures" is specific to the *Rules for the Direction of the Mind*. The expression itself does not appear in any of Descartes' other known writings. Only in the *Conversation with Burman* (1648) do we find a reference to God

as “the **cause** not only of what is actual and to come, but also of what is possible and of the simple natures” (AT V 160, CSMK 343). That said, there is an obvious continuity between the doctrine of simple natures in the *Rules* and the content of some later texts (e.g., *Principles* I.47–48; letter to Elisabeth, May 21, 1643) devoted to “the simple notions of which all our thoughts are composed.” Therefore, to find the expression again in Descartes’ replies some years later is perhaps puzzling but not so surprising.

In the text of the *Rules* itself, the concept of simple natures is introduced in two or three distinct stages. The first is to be found in Rule 6, where it is said that all things, insofar as some may be known on the basis of others, can be arranged sequentially: for any question that we have to solve, the first term (“absolute”) of the series will have within it “the pure and simple nature in question” (AT X 381, CSM I 21). The notion appears again in Rule 8 and has its most complete exposition in Rule 12: in both cases, the question has become that of the composition and limits of human **knowledge** in general. In Rule 12I, Descartes distinguishes between three sorts of simple natures, the composition of which constitutes all the knowledge we can have about other things. There are (a) the purely intellectual natures, which relate only to spirits, such as knowledge, **doubt**, ignorance, or volition; (b) the purely material natures, which relate only to **bodies**, such as **extension**, **shape**, and **motion**; (c) the “common” natures, which are ascribed indifferently to two kinds of things, namely, to any existing thing: of this kind are found **existence**, unity, and duration. One has to add to this last category “those **common notions** which are, as it were, links which connect other simple natures together.” These notions are axioms of the following sort: “Two things which are identical to a same third thing are the same as each other,” etc. (AT X 419, CSM I 44–45).

By **definition**, these simple natures are known in their entirety by a single act of intuition. In other words, they are self-evident (*notae per se*) (AT X 420, CSM I 45). As every definition is a sort of compound, the attempt to define them would confuse that which, in itself, was entirely clear. The truth is simply that one has to make an intellectual effort in order to separate one of these natures from the others. This is because there is no object of our **thought** or **perception** that does not involve several simple natures conjoined together.

In both later texts, the **enumeration** of the simple notions, of which all our thoughts are composed, will be founded upon the distinction between two kinds of **substances** (one thinking and the other extended), which, as such, share some common properties but also have some specific **attributes** or **modes**. The close similarity between those lists and that of Rule 12 gives evidence for an ontological dimension to this first text. This is especially obvious for the series of the “purely material” natures: as will become clearer at the end of Rule 12 and in Rule 14, what is at stake is the reduction of every physical phenomenon to a certain composition of figures and motions, as we can see with the question of the nature of the magnet (AT

X 427) (see **magnetism**). The connection of intellectual natures is also mentioned but without embarking upon any similar theoretical program. In any case, the simple natures of Rule 12 differ from the elementary terms, concepts, or data of Rule 6, as well as from the primary and mainly sensitive qualities that Bacon had called *naturae simplices* (*Novum Organum* I, 121; II, 5, etc.; see Jardine 1974).

Considering that the program in the *Rules* is not that of a metaphysical foundation, Descartes is concerned here neither with providing a complete list of the simple natures nor with justifying their heterogeneity. As regards their noetic content, these natures are not absolutely simple: one can derive from them, by abstraction, some other notions which could seem even simpler, but which are just abstract ones, lacking a genuine ontological status, and that we form only by a sort of comparison (AT X 418, CSM I 44) (see **abstraction versus exclusion**). Moreover, strictly speaking, the special (and not common) natures are unequally simple: for instance, the concept of shape involves confusedly (*confusa quadam ratione*) that of extension; otherwise, there would be no necessary conjunction between them (AT X 421, 3–9). As for the way “all these simple natures contribute to the composition of other things” (AT X 427, CSM I 45–46), beyond some very general assumptions (this composition “can come about in three ways: through impulse, through conjecture or through **deduction**” [AT X 424, CSM I 47]), it is never clearly exposed.

The Cartesian account presents some conventionalist aspects as well as some obvious imperfections. Nevertheless, the simple natures of Rule 12 may certainly not be considered as mere products of the human **mind**, giving form to a reality that would remain enigmatic. Although a sort of analysis is required to isolate them, one may speak here of a direct realism, at least for the material and, of course, for the intellectual ones: these natures are involved in all our perceptions; they hold the first rank in our knowledge of things (and of ourselves); each of them corresponds to one particular dimension of physical or mental reality. It will not be easy to make any further progress in defining their status: Descartes’ disdain for any conceptual specification or formality in the Scholastic style lays down a sort of restrictive law for interpretation.

See also Common Notion, Deduction, Enumeration, Knowledge, Perception, *Rules for the Direction of the Mind*

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DENIS KAMBOUCHNER

SOUL, IMMORTALITY OF THE

The full title of the first edition (1641) of Descartes' most renowned work was *Meditations on First Philosophy in Which the Existence of God and the Immortality of the Soul Are Demonstrated*. On the basis of this title one would expect to find within that text equal effort devoted to proving the immortality of the soul and to proving the **existence** of **God**. Yet, while the latter is given abundant treatment in two separate meditations (3 and 5), neither the noun *immortalitas* nor the adjective *immortale* appears even once in any of the six meditations. Appropriately, the title of the second edition (1642) of the *Meditations* lacked any explicit reference to immortality and promised only to demonstrate, in addition to the existence of God, "the distinction between the human soul and the **body**."

There is good reason to ask, therefore, at least in the case of the *Meditations*, whether Descartes intended to offer any rational support for belief in the immortality of the soul. A negative response to this question is suggested by epistolary evidence that Descartes himself did not choose to mention immortality in the title of the 1641 *Meditations* but that **Mersenne** was responsible for the inclusion: "I am finally sending you [Mersenne] my work on **metaphysics**, which I have not yet put

a title to, so that I can make you its godfather and leave the baptism to you” (AT III 238–39; CSMK 158; see Fowler 1999, 35–53, for the debate on this authorship). However, it will become clear from texts undeniably penned by Descartes that he intended early in his career to prove the immortality of the soul and that he eventually believed that he had offered the strongest possible demonstration for immortality.

A decade before publishing the *Meditations*, in 1630, Descartes expressed to Mersenne his eagerness to complete a “little treatise of Metaphysics” wherein he “set out principally to prove the *existence of God and of our souls* when they are separate from the body, from which their immortality follows” (AT I 182, CSMK 29). Insofar as Descartes is here referring to a metaphysical separation of the soul – its real **distinction** from the body – then this passage is an early indication of Descartes’ belief that the immortality of the soul follows from his **dualism**, a point he will raise and develop multiple times in later writings, beginning with the *Discourse on Method*.

In *Discourse V* (1637), Descartes gives a mechanistic account of several functions of the human body, thereby likening humans to both **animals** and **automata**, but then he distinguishes humans from the latter two through the use of **language** and the greater range of activities humans can perform. Descartes concludes the discussion by relating it to immortality:

When we know how much the beasts differ from us, we understand much better the arguments which prove that our soul is of a nature entirely independent of the body, and consequently that it is not bound to die with it. And since we cannot see any other **causes** which destroy the soul, we are naturally led to conclude that it is immortal. (AT VI 59–60, CSM I 141)

Because human life cannot be reduced to the sum of the **motions** of the human body in the same way that (perhaps) animal life can be, **human beings** have reason to hope that the end of their bodily life does not spell the end of the soul’s life.

In November 1640, Descartes sent the manuscript of the *Meditations* to Mersenne along with a Dedicatory Letter to the Sorbonne. At the outset of the dedication, Descartes remarks that “God and soul [*anima*]” are topics for which **philosophy** ought to offer *demonstrative* proofs; that faith suffices for believers to accept immortality, but that unbelievers require rational arguments for immortality before they will accept it and before they can be motivated to act morally (see **faith, religious**). Descartes expresses his intention to satisfy the 1513 Lateran Council’s injunction on Christian philosophers to refute arguments that conclude that the soul dies with the body and to prove the contrary thesis. However, toward the end of the dedication, when Descartes lists the propositions that he can prove in the *Meditations* with “such a pitch of clarity that they are fit to be regarded as very exact demonstrations,”

he does not mention the immortality of the soul explicitly but notes instead “that God exists and that the **mind** (*mens*) is distinct from the body” (AT VII 5–6, CSM II 6; see Fowler 1999, 161–75, for “mind” versus “soul” in Descartes’ discussions of immortality).

Mersenne was evidently disappointed with the *Meditation*’s treatment of immortality, for Descartes wrote to him on Christmas Eve, 1640:

You say that I have not said a word about the immortality of the soul. You should not be surprised. I could not prove that God could not annihilate the soul, but only that it is by nature entirely distinct from the body, and consequently it is not bound by nature to die with it. This is all that is required as a foundation for religion, and is all that I had any intention of proving. (AT III 266, CSMK 163)

To clear up any future misunderstanding of his intentions regarding this subject, Descartes promised Mersenne to write a Synopsis that would preface the *Meditations*. This short piece is the most substantial Cartesian text treating immortality.

The Synopsis (AT VII 12–16, CSM II 9–11) outlines the steps required for a rigorous demonstration of the immortality of the soul and separates the premises that are established in the *Meditations* from those that must await the development of the “whole of **physics**” (a reference to his later *Principles of Philosophy*). Those elements of the proof to be found in the *Meditations* are: (1) “a concept of soul which is as clear as possible and is also quite distinct from every concept of body”; (2) a demonstration “that everything that we clearly and distinctly understand is true in a way which corresponds exactly to our understanding of it”; (3) “a distinct concept of corporeal nature”; (4) a conclusion based on (1)–(3) “that all the things that we clearly and distinctly conceive of as different **substances** ... are in fact substances which are really distinct” (Descartes gives another argument for [4], independent of [1]–[3], based on the **divisibility** of matter and the indivisibility of mind, which show that these substances are “in some way opposite”). On the basis of these four points, amply treated in the *Meditations*, Descartes believes he has rigorously demonstrated “that the decay of the body does not imply the destruction of the mind,” which in his view is “enough to give mortals the hope of an afterlife.” But to extend this conclusion to the guarantee of an afterlife for the mind, Descartes candidly admits that two more premises are needed about which he has said nothing in the *Meditations*.

The two missing premises are (5) “that absolutely all substances ... are by their nature incorruptible and cannot ever cease to exist unless they are reduced to nothingness by God’s denying his concurrence”; and (6) that the human body easily decays, but the mind is “a pure substance” and thus is “immortal by its very nature.” While the *Meditations* could establish the possibility that the mind could outlive

the body, the whole of physics is required to show that nothing whatsoever (besides God) could destroy the mind (or body taken generally) and that nothing internal to the soul would ever lead to its decay. The term “pure substance” here has been the subject of debate. Prendergrast (1993, 34–35) interprets the term to mark a distinction in kinds of substances, the mind being the only “pure substance.” Fowler (1999, 276–300) argues that the distinction Descartes wishes to draw is not between mind and body taken generally but between mind and *particular* bodies, especially those of humans. Any particular human body has an **essence** that is constituted by the arrangement of its parts and therefore changes every time those accidents change; while the human mind, on the other hand, remains identical while its individual mental events change. The human body, therefore, is *not* immortal because its configuration, which is its essence, can easily change; but body taken generally – that is, the whole of *res extensa* – of which the human body is a part, may also be considered immortal, as Descartes effectively states in premise (5). Purity, therefore, does not restrict immortality to minds.

Four of the six sets of Objections (all but the first and third) appended to the first edition of the *Meditations* raise the issue of immortality. Again, Mersenne was Descartes’ staunchest critic. He pointed out that Descartes did nothing to rule out the possibility that God gave the soul only enough life to last the duration of the body’s existence. Descartes responded that God was absolutely free to destroy the soul and said, concerning whether or not he would do so, that “it is for God alone to give the answer” (AT VII 154, CSM II 109). The literature on this topic is uniform in claiming that Descartes here offered faith as the only possible foundation for belief that God would grant the soul an afterlife.

Despite his promise, Descartes does not extensively develop premise (5) or (6) outlined in the Synopsis in the later *Principles*. There is an elaboration on substance, but it is shown neither that all substances are incorruptible from without nor that they are internally pure in the way Descartes described them. Fowler (1999, 240) suggests that Descartes could not say more because of the dangerous theological implications of his view of substance. Perhaps Descartes simply believed that immortality, as opposed to the real distinction, was ultimately a matter for faith and not **reason**.

An alternative to the common claim that faith, and not reason, ultimately lies at the foundation of Descartes’ proof of immortality is that Descartes established that foundation with moral **certainty**, which is less than the certainty of **geometry** but is still within the realm of reason distinguished from faith (Hickson 2011; Russier 1958, 133–45). Descartes responded to Mersenne, recalling a letter discussed earlier, that “we do not have any convincing evidence or precedent to suggest that any substance can perish” (AT VII 153, CSM II 109). For Descartes, a claim can enjoy moral certainty even if the absolute power of God might render that claim false; all that is required for moral certainty is that the claim be established with enough certainty

for a given practical purpose (AT VIII 327, CSM I 289–90). And as we have seen, Descartes believed his proof was sufficient for the purposes of grounding religion and morality.

See also Certainty; Distinction (Real, Modal, and Rational); Faith, Religious; God; Human Being; Mind; Reason; Substance

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MICHAEL HICKSON

SPECIES, INTENTIONAL

In the *Dioptrics*, Descartes remarks that his theory of the instantaneous mechanical transmission of **light** will deliver “your spirit from all those tiny images flitting through the air, called intentional species, that so much exercise the **imagination** of philosophers (AT VI 85, CSM I 153–54). In this and other passages where he uses “intentional species,” the tone is invariably ironic, even disdainful, and mentioning them serves as foil to his own conception of how the things of the world communicate their presence to the senses.

Intentional species was a topos in Western medieval **Scholasticism** that produced a family of theories and interpretations operating within a complex of empirical and theoretical concerns. How, within the limits of Aristotelian **metaphysics**, **physics**, and psychology, does the **sensation** of material things and their properties occur, and how does sensation prepare the intellectual apprehension of them? The paradigm example was visual, the **perception** of color. For Aristotle color is the proper object, the *proper sensible*, of the visual sense; it is accessible in principle to any **animals** with eyes. How does this quality of real-world things come to be in sensation? Aristotle, in common with most though not all ancient theorists, thought that the effect proceeded from the thing to a more or less passively receptive eye. His physics of actuality and potentiality conceived four conditions needing to be fulfilled so

that vision might occur: (1) a potentially visible material thing; (2) an eye (in a living, awake animal) with the potential for seeing; (3) a transparent medium between thing and eye; and (4) light. Light, rather than reflecting off the object and traveling to the eye, activates the medium's transparency so that it allows the active color quality in the physical thing to be communicated through the medium to the eye; in the eye, the communicated quality produces the same activity that exists in the physical object, though without that object's matter. This activation is seeing proper.

The sparseness of Aristotle's **explanation** led Western Scholastic thinkers, beginning in the thirteenth century and extending into the seventeenth, to explicate the process further, with assistance from theories and concepts worked out by Islamic Aristotelianism. *Intentional species* was the term they coined to bring these efforts to a focus. "Species" indicated an appearing form; "intentional" had the dual indication of the procession of an effect from natural source to destination, and the subsequent direction of a mind aware of the species back to the natural source. Thus, the intentional species was a psychophysical reality, and the process of transmission from object to eye was physical without the species being a physical substance. The ways in which philosophers parsed the meaning of this were so various that it is impossible to characterize simply the kind of physical reality the intentional species had. They were not, however, despite Descartes' characterization, things (or even images, though that is more arguable) that flitted about.

Intentional species also played a crucial role in Scholastic interpretations of how sensory experience leads to intellection – since, as the medieval version of another Aristotelian dictum put it, whatever is in **intellect** was originally in sense. The sensible form borne by the intentional species worked itself into the phantasms of **common sense**, **memory**, and imagination, and in that worked-up form it made possible intellectual abstraction of an intelligible species from the phantasm. Intentional species were also implicated in the medieval optical theory known as perspectivism (see Smith 1987, esp. 32–56). Perspectivism, like most premodern theories of **optics**, aimed to explain vision, and it did this by offering a theory of the specific rays propagated from physical objects that were properly effective in the eye. Perspectivism could further be interpreted as explaining the physical basis of the transmission and effect of intentional species. Perspectivism, in turn, had a larger metaphysical inspiration from a Platonist metaphysics of light (as developed, e.g., by Robert Grosseteste), which understood physical reality as due to lightlike emanations from higher to lower levels of being.

Borrowing concepts from philosophy of science, one might say that the intentional species represents an ad hoc attempt to shore up a degenerate program of Aristotelian **philosophy**. It existed uneasily at the crossroads of many different scientific, mathematical, and philosophical disciplines and was aimed more at resolving problems in Aristotelian philosophy than at understanding and explaining natural phenomena. Once Aristotelianism was rejected, the intentional species no longer

had a place, neither physiological nor physical (much less metaphysical). Descartes' dismissive caricature shows that he believed that his mechanical theory of light plus the real distinction between **extension** and **thought** obviated such a complex artifact of false philosophy and science.

See also Light; Optics; Perception; Quality, Real; Scholasticism; Sensation

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DENNIS L. SEPPER

SPINOZA, BENEDICT (BARUCH) (1632–1677)

Spinoza was born to a family of Marrano Jews that emigrated from Portugal to the Netherlands in order to return to Judaism. Spinoza's first encounter with **philosophy** was most probably through the writings of Maimonides. By the age of fourteen Spinoza left the school of the Jewish community and entered into his family's commercial business. A few years later, Spinoza began studying Latin and came into contact with the circles of freethinkers and the new Cartesians. In July 1656, Spinoza was excommunicated by the Sephardic Jewish community of Amsterdam for reasons still unclear. In the following years, Spinoza deepened his study of Descartes and other philosophers, and in 1663, upon the request of students and friends, he published his book on Descartes' *Principles of Philosophy*, in which he presented the first two parts of the *Principles* in a geometrical manner. Already in this book one can discern a sharp critique of Descartes, a critique that became bolder and more explicit in his later works.

Descartes' philosophy had a decisive influence on Spinoza. Essentially, Cartesian philosophy provided most of the philosophical vocabulary for Spinoza's own system. But despite **Leibniz's** claim that Spinoza "only cultivated certain seeds in the philosophy of Descartes" (G 2.563), Spinoza himself seemed to be deeply disappointed

by what he considered to be Descartes' unprincipled compromises and tendency to accommodate popular religious and philosophical beliefs.

In the *Principles*, Descartes offers an apparently disjunctive **definition of substance**. A substance for Descartes is that which depends either on nothing else for its **existence (God)** or only on God's concurrence for its existence (created substances) (AT VIIIA 24, CSM I 210). Spinoza rejects this compromise, which allows for finite substances, defining a substance as "what is in itself and is conceived through itself"—that is, a being that is ontologically and conceptually independent (E1d3). From this definition, Spinoza infers that if anything is a substance, it cannot be caused by any other thing (E1p6), it exists necessarily (E1p7), and it is necessarily infinite (E1p8).

Spinoza's disagreement with Descartes concerning the nature of substance similarly leads to disagreements on the nature of **attributes**, especially the "principal attribute" of a substance. Descartes writes in the *Principles* that "each substance has one principal property which constitutes its nature and **essence**, and to which all its other properties are referred" (AT VIIIA 25, CSM I 210). In the same passage, Descartes indicates that there are two such attributes: **thought**, in the case of thinking substance (**mind**), and **extension**, in the case of corporeal substance (bodies). According to Spinoza, however, while human minds can know only two attributes, there are infinitely many other attributes that also belong to God or Nature (see E1d6 and Letters 64–66). Descartes believes that it is possible for there to be more than one substance of the same attribute, but Spinoza denies this. He argues in E1p5 that if two substances shared the same attribute, they would be indistinguishable, and therefore identical. In addition, Descartes thinks that one substance cannot have more than one principal attribute – that is, the attributes mutually exclude one another (see the argument for real distinction between mind and **body** in the *Sixth Meditation* [AT VII 78, CSM 2:54] and the *Fourth Replies* [AT VII 227–28, CSM II 159–60]). Spinoza, however, argues that, because the attributes are conceptually independent of one another, they cannot even exclude the presence of each other, and therefore a substance may well have more than one attribute.

With regard to the human mind, one of Descartes' most central doctrines is that the mind is a substance. Descartes writes in the preface to the *Meditations*, for example, that "the human body ... is simply made up of a certain configuration of limbs and other accidents of this sort; whereas the mind is not made up of any accidents in this way, but is a pure substance" (AT VII 14, CSM II 10). Closely related to this doctrine is the claim that thinking substance is indivisible, which Descartes takes as a condition for the immortality of the soul (AT VII 14, CSM II 10) (see **divisibility** and **soul, immortality of the**). Spinoza denied that the human mind is a substance, claiming instead that it is a **mode** "which can neither be nor be conceived without God" (E2p10c). He similarly denied that the mind is indivisible, arguing that, just as Descartes claims that the body is composed of accidents of extension, the mind is composed of affections of the attribute of thought, that is, ideas (E2p15).

One of Spinoza's best-known disagreements with Descartes concerns the distinction between the will and the **intellect**. In the *Fourth Meditation* and in *Principles* I.45, Descartes maintains that his errors are the product of two faculties, the will and the intellect, together with the fact that the will is more extensive than the intellect. Spinoza's response is threefold: he denies that there are mental **faculties** apart from individual **ideas**; he denies that the will and intellect are distinct, insofar as all ideas are inherently affirmative in character; and he denies that the will is free. In E2p48s, Spinoza claims that the faculties of will and intellect are **universals**, or fictions abstracted from particular ideas. He thus denies that there is a faculty of willing apart from individual volitions any more than there is such a thing as "stone-ness" apart from particular stones. Spinoza thus makes the original claim that there is no distinction to be made between having the perception that P and affirming that P (see esp. E2p49s [Spinoza 1925, III.B (ii)]). We are able to deny or **doubt** a **perception** when we have another idea that excludes the thing perceived, or when we perceive that our ideas are inadequate. If, for example, upon seeing the winged horse, I also see glue holding the wings on, or if my perception is joined with the idea that winged horses are merely mythical creatures, I will deny or doubt that I am genuinely seeing a winged horse. Affirmation, denial, and the suspension of **judgment** (which Spinoza characterizes as a "wavering" (*fluctuatio*) of the **imagination** [E2p44s]) are thus not free acts of the will but rather a consequence of the varying power of ideas in conflict. And those ideas have been determined to exist and act by other ideas, and so on ad infinitum (see E2p48, E2p9, E1p32).

See also Attribute, Extension, Free Will, God, Human Being, Idea, Intellect, Judgment, Mode, Substance, Thought

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YITZHAK MELAMED AND JOHN BRANDAU

THE STAMPIOEN AFFAIR

The so-called Stampioen Affair publicly involves only two mathematicians: Jacob Waessenaer, a Utrecht surveyor and cartographer, and owner of a school in applied **mathematics**, who died in 1688 (date of birth unknown), and Jan Stampioen, born in 1610 (he probably died in 1653 in a gunpowder explosion at Arras), who had a somewhat similar position at Rotterdam before being appointed in 1638 or 1639 as teacher of mathematics to Prince William of Orange (1626–50), the son of the stadholder – something which Descartes initially does not seem to have realized (see AT III 736–42). Waessenaer was an able mathematician (according to John Pell [1611–85] one of the best in the United Provinces), who perfectly understood Descartes' *Geometry* (see AT III 735–36). Stampioen seems to have been an excellent teacher and made innovative proposals in the field of mathematical notation (Cajori 1974). In 1633 Stampioen proposed a mathematical problem to Descartes, probably at the instigation of **Isaac Beeckman**. In his answer, Descartes feigns to be an amateur in mathematics but meanwhile solves Stampioen's problem and challenges him to solve the problem of Pappus (AT I 275–79). But although Descartes clearly is pulling Stampioen's leg, there is no animosity. It is not clear why Descartes became involved in what seems to have started as a quarrel between two rival mathematicians. The only intellectual motive one can think of is that in 1639 Stampioen published what he self-importantly called a "new algebra" (Stampioen 1639), which Descartes clearly found bogus. Nor do we know who took the initiative: Waessenaer who sought support against Stampioen, or Descartes himself who either wanted to expose Stampioen as a charlatan or tried to promote the cause of someone interested in his *Geometry*. Descartes' first letter to Waessenaer (and the only one known) dates from February 1640 (AT III 21–28), but he must have been involved earlier (see AT III 6). Waessenaer may even be the Utrecht mathematician referred to in a letter to Mersenne of March 31, 1638 (AT II 99).

In 1638 Stampioen published two problems under the assumed name of Joannes Baptista Antwerpiensis (cf. AT II 601–2). The first concerns the attack on a horn-work (*hoornwerk*—a double bastion vaguely resembling a bull’s head). Waessenaer published his solution in a lost pamphlet of 1638, using Descartes’ “notes” (AT II 605). Stampioen’s second problem concerns three sticks A (6 ft. long), B (18 ft.), and C (8 ft.), erected in a horizontal plane with a distance between A and B of 33 feet. The problem is to determine the exact place and the exact date that the shadow of A passes through B and C; that of B through A and C; and that of C through A – all on the same day. In his reaction, Waessenaer not only showed that Stampioen had taken his problem from Adriaen Metius (1571–1635) but also claimed that he had introduced an error (Waessenaer 1639, 49–52), suggesting that he could solve the problem with a **method** of his own. Moreover, he claimed that Stampioen never provided an intelligible outline of his “new method.” Encouraged by Descartes, Waessenaer proposed a wager. He would reciprocate the sum promised by Stampioen for the correct solution and deposit six hundred guilders. Arbiters would be a committee installed by Leiden University. On Waessenaer’s side, the money was supplied by Descartes. After much deliberation, the committee concluded on May 24, 1640, that Waessenaer’s solution was correct (see AT III 69–70). However, before handing over six hundred guilders to the poor, the rector of the university wanted a second verdict by which the committee would declare that Stampioen had lost. Moreover, Descartes opposed a proposal to give the money to the Leiden Pesthuys – a hospital for impecunious victims of the plague (AT III 154–56). Eventually those difficulties seem to have been cleared for in October 1640 the money was officially delivered to the Pesthuys administrators (AT III 199–201).

See also Geometry, Mathematics

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THEO VERBEEK

SUÁREZ, FRANCISCO (1548–1617)

Suárez was perhaps the greatest of the early modern Scholastics. This Spanish intellectual entered the Society of Jesus in 1564 and thereafter studied theology at the University of Salamanca. He taught **philosophy** and theology at various **Jesuit** colleges, including the Collegio Romano and the Colegio das Artes at Coimbra. In addition to several commentaries on the texts of Aristotle and **Thomas Aquinas**, Suárez wrote perhaps the best late Scholastic treatment of **metaphysics**, his *Disputationes metaphysicae* (1597). In this text, he treated the views of Thomas with great respect, reflecting the fact that the Jesuits were enjoined to follow the teachings of this Catholic saint. Nonetheless, in his text Suárez also sided on points of detail with the anti-Thomistic views of **John Duns Scotus**, and he was not afraid at times to stake out his own distinctive position on the metaphysical issues under consideration.

Despite the importance of Suárez for Scholastic thought, there is no evidence that Descartes knew of him or his work before 1640. During this time Descartes' knowledge of **Scholasticism** derived mainly from the Scholastic textbooks he had studied as a student at La Flèche, which did not include Suárez's metaphysical treatise. Descartes' first reference to Suárez is in his response to **Antoine Arnauld's** objections to the *Meditations*. In particular, Descartes attempted to defend the cogency of his view that claims that certain **ideas** can be "materially false" by appealing to Suárez's own use of the notion of **material falsity** in his *Disputationes*. But though Suárez does anticipate there Descartes' view that there can be a kind of falsity that does not involve **judgment**, he does not conclude, as Descartes does in the Third Meditation, that certain sensory ideas are so obscure that we cannot determine whether they are materially false in the sense that they "represent what is not a thing as if it is a thing" (AT VII 44, CSM II 30) (see Wells 1984).

There is in fact a more substantive connection to Suárez in Descartes' theory of distinctions (see **distinction [real, modal, and rational]**). Descartes was initially prompted to consider the Scholastic theory of distinctions in responding to **Caterus's** objections to the *Meditations*. In this response, he picked up on Caterus's reference to Scotus's view that there can be a "formal or objective distinction"

between inseparable items by identifying this sort of distinction with a “modal distinction” between “incomplete beings” (cf. AT VII 100, CSM II 72–73 and AT VII 120–21, CSM II 85–86). However, later, in the *Principles of Philosophy*, Descartes rejected certain features of the Scotistic theory of distinctions that he had borrowed from Caterus. In this text, Descartes notes that whereas he had earlier conflated a distinction in reason with a modal distinction, it is necessary to separate the two. The manner in which he did so was straight from Suárez: a distinction in reason involves mutual inseparability of a **substance** from some **attribute** of it, whereas there is only a one-way inseparability in the case of a distinction between a **mode** and the substance in which it inheres. As in Suárez, moreover, both of these distinctions are said to differ in turn from a real distinction, which is involved in the case of two or more substances that can exist apart from each other (AT VIIIA 28–30, CSM I 213–15). The differences between the response to Caterus and the remarks in the *Principles* mark a transition in Descartes’ thought from the assumption of a Scotistic theory of distinctions to the adoption of Suárez’s own distinctive theory (see Menn 1997 and Schmaltz 2008, 25–28).

Suárez’s theory of causation also provides important background for Descartes’ own thought on this issue. Suárez concluded from the fact that a **cause** “imparts being to an effect” (*influens esse in effectum*) that the cause must somehow “contain” its effect (Suárez 1967, 1:387), or, as he expresses the point elsewhere in this text, “the effect can have nothing of perfections that does not pre-exist in any of its causes, either formally or eminently, because causes cannot give what they in no way contain” (Suárez 1967, 1:916). This sort of “containment restriction” on causation is repeated in Descartes, who insists in his Third Meditation that “in no way can a stone, for example, which was not before, now begin to be, unless produced by another thing in which there is all either formally or eminently that is found in the stone; nor can heat that was not previously in a subject be induced, unless from a thing that is of at least the same order of perfection as heat, and so for the rest” (AT VII 40–41, CSM II 28) (see Carraud 2002, Schmaltz 2008; and **containment, eminent versus formal**).

Finally, there is a tradition of considering Suárez’s views in connection with Descartes’ (in)famous doctrine of the creation of **eternal truths** (see, e.g., Cronin 1960 and 1961). More recently, it has been claimed that Descartes’ doctrine was in fact a reaction to a kind of “exemplarism” in Suárez that derives from his view that eternal truths are independent of, and inform, the divine **intellect** (Marion 1991). The accuracy of this understanding both of Suárez’s account of eternal truths and of its relation to Descartes continues to be a matter of scholarly controversy.

See also Cause; Concurrence versus Conservation, Divine; Conservation of Motion, Principle of; Containment, Eminent versus Formal; Distinction (Real, Modal, and Rational); Eternal Truth; Falsity, Material; Scholasticism

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TAD M. SCHMALTZ

SUBSTANCE

The notion of substance is meant to address the question, What are the metaphysically most fundamental entities? Substances have traditionally had the following features, although not all philosophers attribute all these features to substances:

1. Substances exist in and of themselves and are neither reducible to nor dependent on more fundamental entities.
2. They remain the same in a process of change; they are the substrata of change.
3. They are genuine unities; they have *per se* unity, in the language of Descartes' time.
4. They retain their identity over **time**.
5. There is an answer to the question what individuates substances at a time.

Descartes' writing displays a clear position on the first two features; matters are complicated for the third, *per se* unity; and the last two features are not focal points of Descartes' analysis of substance: he does not address identity over time or **individuation** for **minds**, and when he does so for **bodies**, it is not connected to his notion of substance. Before addressing the most controversial question about what Descartes counts as substances – in particular, whether he thought there is a multiplicity of

corporeal substances and whether he thought human mind-body composites are substances – we first consider Descartes’ own most prominent characterizations of substance.

1. WHAT IS IT TO BE A SUBSTANCE?

The notion of substance as it came down to Descartes originates in Aristotle’s division of beings into ten categories. These categories contain, on the one hand, the category of substance and, on the other hand, nine categories of accidents, to use the Scholastic term. This means that, intuitively speaking, it is the distinction between individual things and all manner of qualities, properties, states, and relations of things. This distinction between substance and accident is helpful to understand Descartes’ notion of substance. A substance is, in terms used by Descartes and his Scholastic predecessors, something that exists *per se*, in its own right. On the other hand, accidents (or qualities) exist *per aliud* or through another – that is, they exist by inhering in another thing, typically a substance. It is of the nature of a quality that it must so exist: a **shape** cannot exist by itself free-floating. It exists in virtue of belonging to or inhering in a substance or thing. In this context, it is important that accidents were understood as individual instances of qualities and the like. So the determinate shape of this table and the particular thought that occurs in my mind when I think of **God** qualify as accidents in this sense. Nowadays, such qualities are sometimes called “tropes.” In Descartes’ terminology, the contrast between substance and accident is the contrast between substance and **mode**.

There are then two aspects to Descartes’ conception of substance: it is the subject of modes, and it exists *per se*, in its own right. In the **Geometrical Exposition**, appended to the Second Replies, he focuses on the first aspect: “Substance. This term applies to every thing in which whatever we perceive immediately resides, as in a subject, or to every thing by means of which whatever we perceive exists. By ‘whatever we perceive’ is meant any property, quality or attribute of which we have a real idea” (AT VII 161, CSM II 114; cf. AT VII 222, CSM II 156). More often he focuses on the second aspect, the *per se* **existence** of substances. At *Principles* I.51, Descartes defines substance as a thing “that so exists that it needs nothing else in order to exist” (AT VIIIA 24, CSM I 210). And in the Fourth Replies, he states that “this is the very notion of substance, namely that it can exist without the help of any other substance” (AT VII 226, CSM II 159). These two aspects of the notion of substance are logically independent, but for Descartes they are two sides of the same coin (cf. Markie 1994, Woolhouse 1993).

Descartes’ notion of substance is sometimes characterized modally: a substance is that which *can* exist apart from anything else (Hoffman 1986, 2009). Descartes goes back and forth between describing substance as what is *capable* of subsisting *per*

se and as *res per se subsistentes* (AT III 502, CSMK 207; AT VII 222, 226, CSM II 157, 159; AT VIIIB 348, CSM I 297). But it is natural to take his view to consist in the second, stronger claim. Notice that in the **definition** from the *Principles* he writes that a substance “*so exists* that it needs nothing else in order to exist.” So its actual mode of existing *has as a consequence* that it is independent of other things. On the other hand, a mode exists by inhering in a substance and consequently it depends on that substance, and cannot exist without it. In other words, a substance has its own act of **existence**, but a mode does not. As Descartes writes to **Elisabeth**, thinking of a quality as having its own act of existence means thinking of it as a substance (AT III 667, CSMK 219).

In Descartes’ thought, there are two types of created substance – minds and bodies – and one infinite substance, God. Each created substance has one principal **attribute**, which constitutes its nature and **essence**: **thought** for mind, **extension** for body, and of which the modes of a substance are its modifications. A substance is merely conceptually distinct from its principal attribute and cannot be clearly and distinctly understood without it (AT VIIIA 25, 30–31; CSM I 210, 213) (see **distinction [real, modal, and rational]**). This entails that a substance is not a bare particular or substratum. Furthermore, a mode cannot exist or be understood clearly and distinctly without its substance and its principal attribute. Thus **sensation** and **imagination** are modes of thought; shape, size, and **motion** are modes of extension. Each type of mode pertains to a particular type of substance (AT VIIIA 24–25, CSM I 210–11). The principal attribute determines what types of modes a substance can have. Finally, all substances have generic attributes that, like the principal attribute, are unchanging – namely, existence, duration, number.

A complication arises from Descartes’ claim at *Principles* I.51 that his definition of substance strictly applies only to God, because all created substances depend on God (AT VIIIA 24, CSM I 210). He concludes that the term “substance” does not apply univocally to both God and creatures. There is something puzzling about Descartes’ making this move. For it is true that for him created substances are dependent on God for their existence, and so they do need another substance in order to exist. But the reason they so depend is different from the reason a Cartesian mode depends on its substance. God is the efficient cause of the existence of substances; he gives them existence, and then they exist without existing in something else. In this sense they are *res per se subsistentes*. But a mode depends on its substance not as an efficient cause but as its subject of inherence. Modes exist in virtue of the act of existence of the substance they belong to; they do not have their own act of existence, which would make them substances. So the characterization in the *Principles* seems to fuse together two types of dependence for existence and thus to lose track of the conception articulated elsewhere as a *res per se subsistens* grounded in the Aristotelian tradition of the contrast with an accident that exists *per aliud*. Descartes himself

generally ignores this complication in his conception of substance. Later, **Spinoza** exploits it by arguing that all creatures are modes of the one divine substance.

In the Synopsis to the *Meditations*, Descartes presents a different angle of substance that, according to some interpreters, creates tension with the conception of substance as an independent subject of inherence (Markie 1994): “Substances, or [*sive*] things that must be created by God in order to exist, are by their nature incorruptible and cannot ever cease to be unless they are reduced to nothing by God denying them his concurrence” (AT VII 13, CSM II 10) (see **concurrence versus conservation, divine**). And in a letter to **Regius**: “It is contradictory [*repugnet*] that a substance should come into existence without being created from nothing by God.... This is confirmed by the example of the soul, which is the true **substantial form** of the **human being**. For the soul is thought to be immediately created by God for no other reason than that it is a substance” (AT III 505, CSMK 208). From an Aristotelian perspective this is a very striking view: for prominent among Aristotelian substances are natural or corporeal substances that are composites of matter and form, and that are generated and corrupted by natural processes. But Descartes makes clear here that he does not countenance such substances.

On what ground does Descartes hold this view? He does not say. His view constitutes a turn to an alternative to an Aristotelian conception of substance, a view exemplified by Plato or the atomists, on which the most fundamental entities do not ever go into or out of existence – with the Christian twist that, for Descartes, God creates them and can annihilate them. Clearly part of his view is that substances lack composition in an important sense. The process of natural ceasing-to-be was generally thought to require composition from entities that then can be separated, which process results in the demise of the substance. Descartes denies such composition, but he does not have just any composition in mind. Within Aristotelianism, the composition at issue is one of matter and form, and he is aiming to deny this possibility. The terms “corruption” (*corrompere*) and “perishing” (*interire*) were often used specifically in **Scholasticism** to refer to the process of substantial change where matter and form separate (Kaufman, unpublished). But Descartes rejected substantial forms, except for the case of the human soul, where, as he explained to Regius in the letter quoted previously, he sees such a form as an incorruptible substance (Rozemond 2010, Fowler 1999) (see **soul, immortality of the**).

Descartes does not deny all forms of composition for substances. In the Synopsis, he writes that *both* mind and body are incorruptible because both are substances, or rather, body in general is a substance (more about this nuance in a moment). But he also writes there that while the mind is indivisible, the body is divisible. Some interpreters have identified the notions of divisibility and corruptibility, but they are in fact different notions (see **divisibility**).

2. CONTROVERSIAL CASES OF SUBSTANCE: HUMAN BEINGS AND BODIES

There is no controversy about the question whether created minds count as substances. But there is significant controversy about the status of human mind-body composite and bodies.

Descartes' conception of substance as incorruptible implies that human mind-body composites are not substances, contrary to what some interpreters have claimed (Hoffman 1986, Markie 1994), for such composites are corruptible. Indeed, Descartes never calls such composites "substances." The terms he does use suggest he is carefully avoiding doing so; "some one thing" (*unum quid*) and a subject (*subiectum*) that is a composite (AT VII 81, CSM II 56; AT VIIIA 350–51, CSM I 299).

Some turns of phrase Descartes does use may suggest that he did think the mind-body composite is a substance. First, he calls a human being an *unum per se* or an *ens per se*, and he sometimes identifies substances and *entia per se* (Hoffman 1986). But there are two uses of the term *en per se*; one of these is contrasted with an *ens per aliud*, and in this sense an *ens per se* is a substance. When Descartes calls the human being an *ens per se*, however, he contrasts it with an *ens per accidens*, that is, an entity that has accidental unity. That sense of the term applied to substances but also to other entities, including even accidents, that display a genuine type of unity. Second, he called mind and body incomplete substances in relation to the human being (AT VII 222, CSM II 157). This seems to imply that the human being is a complete substance. But a close reading reveals that he did not mean to say mind and body are incomplete *qua* substances, but incomplete with respect to the notion of the human being: neither mind nor body by themselves are sufficient to constitute a human being. Descartes also speaks of a "substantial union" of body and mind, but he never makes clear what this means (Rozemond 1998, Brown unpublished).

There is much disagreement about what counts as substances in the realm of body. This controversy concerns the question whether Descartes believed that there is a plurality of corporeal substances or only one. The texts strongly suggest a pluralist interpretation. First, when Descartes explains the real distinction at *Principles* I.60, he writes that "properly speaking a real distinction obtains only between two or more substances." And the *first* application of a real distinction he offers is to corporeal substance: "Every part of [extended or corporeal substance] defined by us in our thought [*a nobis cognitione definitam*], is really distinct from the other parts of the same substance" (AT VIIIA 28, CSM I 213). So in this important text he clearly commits himself to the view that there is a plurality of really distinct corporeal substances. While he argues that mind and body are really distinct because we can conceive them apart on the ground of their different natures, parts of a body are really distinct because we can conceptually distinguish parts within

any body. Bodies are extended, and thus, for Descartes, always divisible. Second, on a number of occasions he refers to individual bodies as substances – for instance, a hand, a human body, a stone (AT VII 78, CSM II 54; AT VII 222, CSM II 157; AT VII 44–45, CSM II 30–31).

On the monist view there is only one corporeal substance, at least strictly speaking, and Descartes' position resembles Spinoza's (Gueroult 1983, 63–74; Lennon 2007; Nelson and Smith 2010; Sowaal 2004). Monist interpretations sometimes hold that for Descartes bodies are modes rather substances, in spite of his referring to bodies as substances. On the other hand, sometimes monists posit that there are two different senses of substance within the created world: one applies to the entire physical world, the other to individual bodies (Sowaal 2004, Nelson and Smith 2010).

Monists see Descartes' discussion of substance in the Synopsis as supporting their interpretation. He there claims that "body in general" (*corpus in genere sumptum*) is incorruptible, and they take this phrase to refer to the entire physical world. But Descartes' use of this phrase elsewhere suggests that instead of referring to the entire physical world, it means rather something like "body taken as such, that is, a chunk of extended stuff." Contrasting "a body in general" with a human body, he writes: "When we speak of a body in general [*un corps en general*], we mean a determinate part of matter, a part of the quantity of which the universe is composed" (AT IV 166, CSMK 241–42; see also *Principles* II.12 and Kaufman 2014).

In the Synopsis, Descartes also contrasts this notion with a human body, which "insofar as it differs from other bodies is nothing other than a certain configuration of limbs and other accidents" (AT VII 14, CSM II 10). Monists see Descartes as claiming here that the human body is a mode. But he here contrasts the human body with "body in general," which he claims is a pure substance. This suggests that the human body is an *impure* substance, that it is *an extended substance as modified in specific ways*: a hybrid entity. It can easily perish (*interire*), he claims, as a result of changes in its shapes or parts. Its corruption consists in alterations in modes, and the result would be something of a different kind (a corpse, ashes). The chunk of matter that constitutes it, body as such, is a pure substance, and it never perishes: no alteration in modes will result in the destruction of extended substance.

The monist position is motivated more by philosophical than textual reasons. First, bodies seem to fail the criterion of separability that is central to Descartes' conception of substance and his notion of real distinction. Addressing this problem involves asking what the criterion of independence involved in substancehood amounts to. The separability problem presents itself as follows: when a and b are two different substances, they must be really distinct and able to exist apart. But Spinoza argues that bodies fail this separability test, and he concludes that there is only one corporeal substance (E1P15S). His argument relies on the idea that a **vacuum** is impossible, a view Descartes accepts (see **atom**). Consequently, if a body were annihilated

by God, a vacuum would result, which is impossible. This ultimately means that each body requires the existence of all others. Or one may approach the problem from a different angle: God cannot create one single body without creating the entire physical world because the world is indefinitely large in size (Normore 2008). So again no body can exist without the rest of the physical world. Spinoza concludes that there is only one material substance and individual bodies are modes of the substance. There are various possible solutions to this problem (Rozemond 2011).

It is useful to turn to **Suárez**, whose treatment of the relevant issues is much more extensive than Descartes'. For Suárez, a real distinction is "a distinction between thing and thing [*rei a re*] which consists in the fact that one thing is not another thing and vice versa" (Disputationes metaphysicae VII.I.1). Suárez does not think the real distinction consists in separability: he saw separability as a *sign* of real distinction. Furthermore, he distinguishes between two different senses of separability: (1) the ability of A to exist *without B existing* and vice versa, and (2) the ability of A to exist *without a real union with B* (DM VII.II.9). Suárez argues that the second sense always obtains between really distinct entities (DM VII.II.22). Matters are more complicated for the ability to exist without the other entity existing. Suárez writes that generally this condition obtains for really distinct entities, but he lists three exceptions: God and creatures; a relation and its terms; and the persons of the Trinity (DM VII.II.24–27).

Like Suárez, and contrary to a common assumption, Descartes also did not think the ability to exist apart constitutes a real distinction (see **distinction [real, modal, and rational]**). Descartes discusses separability as a possible sign for real distinction, thus implying it does not constitute a real distinction (AT VII 132, CSM II 95.). This suggests that separability is sufficient but not clearly necessary for a real distinction. Consequently, two bodies could perhaps be really distinct even if they cannot exist apart.

Second, Descartes is not very explicit about what type of separability he has in mind (see Hoffman 2002 for several options). He describes a real distinction as a distinction between substances, and so the independence he attributes to them can be helpful in explaining the separability involved in real distinction: "The very notion of a substance is the notion of something that can exist *per se*, that is, *without the help [ope]* of any other substance" (AT VII 226, CSM II 159). This suggests that the notion of the ability to exist apart relevant to the notion of substance is the idea that one entity contributes in some way to the existence of another entity; in that case, Descartes has separability with respect to union in mind. But the monist argument from Spinoza relies on the stronger notion of separability with respect to existence: substance A can exist without substance B existing, not just without a real union with B. Consequently, the plurality of corporeal substances is not clearly endangered by the Spinozistic argument.

Third, another, connected response proposes that for something to be a corporeal substance it must fulfill the following requirement: A is a corporeal substance if and only if for any particular B, A can exist without B existing. That is, a body is a corporeal substance, and meets the separability criterion, if it can exist when any other particular corporeal substance is annihilated, so long as God supplies another substance in its place (Leibniz, “Draft of letter to De Volder,” June 23, 1699; Leibniz 2013; Normore 2008).

The second philosophical worry that motivates the monist is the question of how bodies are individuated. This is a difficult question, and resolving it goes well beyond the scope of this entry (see **individuation** and **shape**). Descartes is remarkably quiet about the question of individuation, both about bodies and about minds. Since Descartes regarded matter as inherently divisible, it is not clear, as **Leibniz** repeatedly charged, how he can maintain that any body has the requisite unity to be a single substance (Leibniz 1989). Leibniz concluded that Cartesian matter by itself is not a substance. Descartes sometimes claimed that bodies are individuated by motion (AT VIIIA 53–5, CSM I 233), but this account is seriously problematic. Instead, like **Ockham**, he may have regarded individuality for minds as well as for individual chunks of extended stuff as primitive. For Descartes, motion then does not provide with us with an account of individuation in a fundamental metaphysical sense, but provides us with a way of picking out bodies for the purpose of doing **physics** (Normore 2008).

In sum, for Descartes a substance is a thing that exists in its own right as opposed to inhering in something else. Substances are independent beings, as opposed to modes, for which they serve as subjects of inherence. However, created substances are dependent on God, and this moves Descartes to say that the term “substance” does not apply unequivocally to God and creatures. Furthermore, substances are incorruptible; they come into and go out of existence only in virtue of divine activity. Minds are substances uncontroversially. While some interpreters regard mind-body composites as substances, Descartes studiously avoids applying that label to them. While some interpreters think he holds that only the entire physical world counts as a substance in the strict sense, Descartes explicitly commits himself to the plurality of corporeal substances. Created substances are independent of one another and really distinct. Questions arise about the plurality of corporeal substances on account of the notion of separability involved in real distinction. This separability is best understood not as separability with respect to existence but with respect to union. And it is sufficient for separability that each substance can exist without every other specific substance. It is not necessary that a substance be able to exist without there being any other substances.

See also Atom; Body; Distinction (Real, Modal, and Rational); Divisibility; Form, Substantial; God; Human Being; Individuation; Metaphysics; Mind; Mode; Quality, Real; Scholasticism; Shape; Spinoza, Benedict; Suárez, Francisco; Vacuum

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SUBTLE MATTER

Subtle matter is for Descartes, as for some ancient and medieval predecessors, the imperceptibly small parts of matter. Indispensable to any theorist denying the **vacuum**, subtle matter exists between observable **bodies** and within their pores (AT I 139–40, CSMK 21–22). Only one sort of subtle matter appears in the *Dioptrics* and *Meteors*, a highly fluid matter that fills the heavens and is responsible for **light** transmission. Although at this time Descartes describes subtle matter as “continuous” as well as “fluid” (AT I 417, CSMK 63), he later explains its fluidity in terms of the rapid **motion** of small constituent particles. In **correspondence** with **Mersenne** (AT II 483, CSM III 132–33), Descartes reveals that the term “subtle matter” actually encompasses two kinds of matter, and his *Principles of Philosophy* (1644) accordingly asserts, hypothetically, a total of three “**elements**” or kinds of matter (AT VIIIA 105, CSM I 258). In conformity to his identification of matter with **extension**, these differ only in size, **shape**, speed, and function (AT II 484–85, CSMK 133) and are thus transformable into one another through erosion and accretion (AT VIIIA 105, 142–44, CSM I 258, 262; AT VIIIA 206, CSM I 267). Subtle matter comprises primary and secondary matter, while the tertiary element constitutes the large particles of observable bodies, including the earth, other planets, and comets. Primary matter, which constitutes the sun and fixed stars (AT VIIIA 105, CSM I 258), includes the smallest and fastest-moving particles. Because these particles also fill the spaces (so to speak) between larger particles (AT VIIIA 104, 119, 144–45, 207, 213; CSM I 258, 261, 262, 268, 269), most lack any determinate shape, continually adjusting to those so-called spaces (angular-shaped exceptions are discussed at AT VIII 144, CSM I 262). Particles of secondary matter, a constituent of celestial vortices (AT VIIIA 105, CSM I 258), typically have determinate, spherical shapes, any corners having been worn away by collisions. These particles fill the pores of large bodies (primary particles filling the gaps between secondary ones) (AT VIIIA 103–4, CSM I 258).

In addition to ensuring the material **plenum** and transmitting light, subtle matter explains such phenomena as sight (explained in terms of subtle matter’s pressure upon the optic nerve) (AT VIIIA 108–15, CSM I 258–60; AT VIIIA 319, CSM I 283), **rarefaction and condensation**, heat (AT II 485, CSMK 133), sunspots (which arise from accretion of subtle matter) (AT VIIIA 148–50, CSM I 262–63), **magnetism** (AT III 816, CSMK 220; AT VIIIA 275, CSM I 275), and comets (AT VIIIA 162–69, CSM I 263–64). Further, vortices of subtle matter account for the circular motions of celestial bodies (AT VIIIA 89–92, 192; CSM I 251–54, 265) and the **gravity** of terrestrial ones (AT VIIIA 212–16, CSM I 268–70). Magnetic phenomena arise from long, spiral-shaped particles, those emerging from the Northern and Southern Hemispheres respectively twisting in opposite directions, and reentering the earth in the hemisphere opposite to that from which they emerged. Subtle matter circulating in celestial vortices causes the earth to spin on its axis and carries all the planets

around the sun. By its tendency to move away from the earth, the celestial **vortex's** subtle matter pushes terrestrial bodies downward, producing the phenomenon we know as the gravity or heaviness of terrestrial bodies.

See also Element, Gravity, Magnetism, Meteors, Motion, Plenum, Rarefaction and Condensation, Vortex

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HYLARIE KOCHIRAS

SYLLOGISM

In his *Prior Analytics*, Aristotle developed what has become known as his "syllogistic," a word derived from the Greek *sullogismos* (deduction) or "syllogism" in English. He defines it thus: "A **deduction** is a discourse in which, certain things being stated, something other than what is stated follows of necessity from their being so" (*Posterior Analytics* I.2 24b18–20). His syllogistic is a metalogical theory in which certain argument schemas are meant to capture the form of any deductive inference. Although this is no longer believed to be a successful enterprise, Aristotle is nevertheless credited with the invention of schematic letters for predicates and subjects ("terms"), which he thinks together can represent singular and universal propositions of either positive or negative modes. Schematically, a universal affirmative proposition has the form "Every S is P," while a singular affirmative has the form "Some S is P," and so on. A syllogism in standard form has two premises and a conclusion in which terms are distributed in various ways. Since a universal affirmative proposition has come to be called an "A" proposition, one standard deductive schema is now called **Barbara**. Aristotle writes: "If A is predicated of every B, and B of every C, A must be predicated of every C." Aristotle's logical theory is far more complex and subtle than a brief exposition can suggest, and although it is imperfect, it had a profound influence for many centuries, especially on **Scholasticism**.

Descartes is highly critical of syllogistic reasoning, which he associates with Scholastic logicians or what he calls "dialecticians," a pejorative term meant to imply

that they were more interested in verbal disputes and sophistry than in the **truth**. The main problem with formal argumentation of any kind is that it dims the light of **reason**, which consists in perceiving something clearly and distinctly (see **clarity and distinctness**). In another memorable metaphor from the *Rules*, Descartes says that when trafficking in argument forms, our reason “takes a holiday” (AT X 405–6, CSM I 36). Like the ancient skeptics (and anticipating Mill), Descartes also thinks that syllogisms are circular; there is a strong sense in which the conclusion is already contained in the premises, and hence such arguments do not provide a means for discovering new **knowledge**. If the syllogism has any use at all, it is to explain to others truths one has discovered by other means. “It should therefore be transferred from philosophy to rhetoric” (AT X 406, CSM I 36–37).

Despite these criticisms, Descartes sometimes presents his arguments as syllogisms, largely in order to appeal to his Scholastically trained readers. This is especially noteworthy in the context of the **ontological argument**, which he often presents as a traditional three-step syllogism, containing “major” and “minor” premises, where the major premise consists in a **definition** of the divine **essence** (see, e.g., AT VII 115–16, CSM II 83). There is also an important scholarly debate about whether the *cogito* (“I think, therefore I am”) is intended as an enthymematic syllogism, whose missing premise is “whatever thinks exists.” Descartes denies it in the *Second Replies*: “When we become aware that we are thinking things, this is a primary notion which is not derived by means of any syllogism.” He adds:

When someone says “I am thinking, therefore I am, or I exist,” he does not deduce **existence** from **thought** by means of a syllogism, but recognizes it as something self-evident by a simple intuition of the mind. This is clear from the fact that if he were deducing it by means of a syllogism, he would have to have had previous knowledge of the major premiss “Everything which thinks is, or exists”; yet in fact he learns it from experiencing in his own case that it is impossible that he should think without existing. It is in the nature of our mind to construct general propositions on the basis of our knowledge of particular ones. (AT VII 140–41, CSM II 100)

In *Principles* I.10, however, Descartes says that in affirming his own existence he was not denying “that one must first know ... that it is impossible that that which thinks should not exist” (AT VIIIA 8, CSM I 196). This remark, together with the use of “therefore” (*ergo*), suggests that the *cogito* is an argument. But in the *Conversation with Burman*, a general proposition like “whatever thinks must exist” is said to be present from birth (i.e., innate) and hence prior to particular thoughts but only in nascent form. One becomes conscious of such propositions only in the presence of particular instances (AT V 147, CSMK 333) (see **idea**). In an effort to reconcile

these disparate passages, one might say that the *cogito* depends on a general but only implicitly known principle, until one is confronted with the particular case of one's own thought (cf. Cottingham 1976, xx–xv).

See also *Cogito Ergo Sum*, Deduction, Definition, Idea, Knowledge, Ontological Argument

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AL SPANGLER AND LAWRENCE NOLAN

THOUGHT

While examining his nature in the Second Meditation, Descartes famously finds that he is “in the strict sense only a thing that thinks” (*res cogitans*), that thought is inseparable from him, and that the nature of his self or **mind** (or soul) consists in thinking alone (AT VII 27, CSM II 189). In the new, broad sense of the term here introduced, thinking covers not only functions traditionally attributed to mind, **intellect**, or **reason**, such as judging, understanding, conceiving, and reasoning, but any kind of cognitive and conative act, like doubting, affirming, denying, willing, and not willing, as well as imagining and having sensory **perceptions** (AT VII 28, CSM II 19). In addition to those of the rational soul, all of the functions of what in the Aristotelian tradition were attributed to the animal and sensitive soul are attributed to the mind in a new, broad sense and treated as different kinds or modes of thought. The traditional architecture of mind and cognition has been, it seems, reversed. Instead of serving as the foundation required for the intellect to do its work of abstraction and understanding, sensory perception, although also requiring bodily organs, now depends on the mind and its capacity to think and understand.

One can roughly distinguish two main strands for later theorizing about mind and thought that can be traced to the *Meditations* and are likely to color one’s understanding of the notion of thought defining the being discovered in the Second Meditation. One grows out of the empiricist tradition and emphasizes consciousness as distinctive for or even identical with thought or mind. The focus here, using a recent slogan, is on what the mind *is*, and on what a particular thought *is* (or *feels*) *like*, as opposed to what the mind does or how it acts and operates (Chalmers 1996, Brandom 2002). The second strand with roots in the Aristotelian-Scholastic tradition focuses on what mind *does* and sees the exercise of its various intellectual capacities and the standards governing them as essential to thought. It lives on from Descartes to Kant and beyond to those who take their inspiration from Kant rather than from the British empiricists in their accounts of cognition and the relation between thought and the world.

While arguing in the Second Meditation that he is merely a thinking thing, Descartes concludes in the Sixth Meditation that his mind is “quasi-intermingled [*permixtum*]” with his **body** and forms a substantial composite with it (see **human being**). The fact that he finds in himself these “**faculties** for certain special modes of thinking” – **imagination** and sense perception – now serves as a proof of the mind-body union. As a thinking being he can clearly and distinctly understand himself “as a whole” without them, but he cannot understand these faculties without his self or mind, “that is, without an intellectual **substance** [*substantia intelligente*] to inhere in.” Imagination and sensory perceptions are modes of thought because their very notion includes “some kind of understanding [*intellectionem nonnullam*]” (AT VII 78, CSM II 54; AT IX 62). This suggests that *qua* thinking thing, the mind, in

the strict sense, is a power of understanding. It is the very same power that when it understands (*intelligit*; the French translation has *concevoir*) is said to “turn in some way towards itself to inspect [*respiciat*] some of the **ideas** that are within it,” and which is said to imagine when it turns itself toward the body to “consider (L. *intueatur*; Fr. *considere*, CSM “looks”) something in the body that conforms to some idea it conceives through the intellect or perceives through the senses [*vel sensu perceptae*]” (AT VII 73, CSM II 51). What do these special modes of thinking, whereby the mind considers the body, contribute that understanding cannot do by itself?

Clear and distinct general ideas of extended body (e.g., geometrical ideas) are conceived by the intellect, which has a natural power to form them. In analyzing his cognition of any common object like a piece of **wax** in the Second Meditation, Descartes finds that its nature as a particular bit of **extension** is also distinctly known only through the mind in the strict sense of intellect. Yet the wax first presented itself to him through its perceived qualities, which had to be, as it were, stripped of them to reach this conclusion (AT VII 33, CSM II 22). Ideas of imagination that are not innate (i.e., conceivable by the intellect alone) include images of **shapes** and figures, colors, sounds, tastes, and pain, which come from the senses or **memory**, where sensory ideas are stored. Examining the ideas or perceptions of sensory qualities presenting themselves to him as through the internal or external senses and noting that they were the only things “he properly and immediately sensed” (*sentiebam*), Descartes concludes in the Sixth Meditation that “he sensed things altogether different from his thought, namely, bodies from which these ideas proceeded” (AT VII 75, CSM II 52). While being more or less clear, these ideas typically lack the distinctness of intellectual perceptions. In the narrative of the *Meditations*, sensory ideas, tested by methodic **doubt** in the First Meditation and characterized as obscure and confused “adventitious” ideas in the Third, turn out in the Sixth Meditation to be the “the sole source” of our cognition of actually existing particular corporeal things (AT VII 75, CSM II 52). Sensory perceptions, when not mistaken for what the Scholastics treated as “real qualities,” offer the main evidence for the **existence** of body to which the mind is united, and of the things in the external world acting on its senses. The evidence consists in their liveliness and the fact that they offer themselves to thought uninvited, actualizing an irresistible natural inclination or impulse to believe in the existence of the things taken to **cause** them (AT VII 79–81, CSM II 54–56).

Given Descartes’ distinction between mind and body, his inclusion of imagination and sensory perception that depend on bodily organs among “modes of thought” raises questions about how his notion of thought should be understood. **Locke** and his followers in the empiricist tradition have tended to identify thought with consciousness. The latter term itself does not occur in the text of the *Meditations*, although Descartes does explicate his notion of thought in terms of what one is “immediately aware of” in his more formal **definitions** of thought in

the Second Replies (AT VII 160, CSM II 113) and the *Principles* (AT VIIIa 7, CSM I 195). An influential reading inspired by Gilbert Ryle focuses on consciousness as the key element in the Cartesian notion of thought. In what he calls the “Myth of the Ghost in the Machine,” Ryle (1949, 14–15, 154–55) construes a picture of the Cartesian mind enclosed in a private space, as it were, within the body, exempt from the **laws of nature** governing the latter. It is not an object of sensory perception and can be accessed only through inner consciousness or introspection. In fact, according to Ryle’s Myth, (1) “a mind cannot help being constantly aware of all the occupants of its private stage” and, moreover, (2) “it can also deliberately scrutinize by a species of non-sensuous perception at least some of its own states and operations.” Consciousness and introspection are, supposedly, exempt from error. For decades, privacy, transparency, and incorrigibility were associated with the Cartesian notion of thought as its main characteristics (see also Wilson 1978, 150). Since the **knowledge** of mind and its mental states is supposedly revealed through self-consciousness and introspection – the so-called method of privileged access, not accessible to other minds or third-person observation – it is, paradoxically, at the same time private and certain. This subjective mode of cognition was offered by Descartes and his followers as a paradigm of **certainty** (see, e.g., Kenny 1966).

The picture emphasizing consciousness and even treating it as synonymous with Descartes’ wide concept of thought has fed much of modern philosophy of mind. It is the ancestor of contemporary views that see the problem of consciousness, intractable in terms of physicalist theories, as the central problem of philosophy of mind. It is, however, rooted more in empiricist developments of Descartes’ notion of thought than in his own account. The term “consciousness” is not found in the *Meditations*, and “being conscious of” is mentioned only once in the text itself (AT VII 49, CSM II 234). The terms occur only a few times in the *Objections and Replies*, where neither the French *conscience* nor the Latin *consciūs* and *conscientia*, with their epistemological and moral connotations, have quite the same meaning as their English translations used in later discussions (Rodis-Lewis 1950).

Descartes does privilege clear and distinct ideas, and he does emphasize the indubitability and immediacy of the clear and distinct cognition that he thinks. The Second Meditation, where the argument that he knows that he exists *qua* thinking is laid out, is announced as being about the nature of the mind, that it is better known than the body. The paradigm object of clear and distinct knowledge, however, is not the mere experienced phenomenon or awareness of thinking but, more significantly, the **truth** of the **judgment** that he exists whenever he thinks and its recognition. He discovers his existence as a thinker in discovering his power to reason and understand, through exercising his core capacities as a “cognitive agent” (Carriero 2009, cf. Hatfield 2003). Carriero (2009, 91–94) characterizes Descartes’ “thing that thinks” as a cognitive agent or “*cogito*-being” rather than “mind” to steer

clear both from pre-Cartesian associations of mind with intellect or intelligence alone and from the post-Cartesian readings of mind that focus on consciousness. The term “thinking” suits Descartes’ purposes better than “intellect” or “mind” because the self who now knows her own existence is a being that not only sees the truth but, more importantly, judges that things are thus and so. Judgment according to Descartes involves two elements, intellect and will, which are both covered by “thought.” Understanding and willing are the core activities of the *cogito*-being, that is, of the mind or self in the strict sense discovered in the Second Meditation.

Things are more complicated, though. As we have already seen, the newly discovered Self or *cogito*-being is a being that also imagines and senses – activities that are included among modes of thought even though the things imagined or sensed are not distinctly known and are still treated as doubtful. The relevant passage (AT VII 29, CSM II 19 par. 9) is controversial, and Descartes has been read at this point as turning sensory perception into a mere phenomenon of immediate subjective consciousness. Veridical perception, for example, seeing a dagger, and illusory or imagined perceptions, for example, seeming to see, or dreaming that one sees a dagger, would have a common element, a felt quality that is identical in both cases and constitutes the very nature of **sensation** that Descartes classifies as a thought (see, e.g., Kenny, 1968, 70–75; for a different interpretation, see Baker and Morris 1996, 72–77; Carriero 2009, 102–5). The consequences of this alleged redefinition of sensation have been seen as momentous:

Descartes’s innovations influenced philosophers outside the Cartesian tradition. Ideas, impressions, and sense-data are all, by Cartesian standards, mental entities; and for the British empiricists they are all epistemologically prior to the physical substances of the problematic external world. For Locke, Berkeley and Hume, no less than for Descartes, mind is better known than body in the sense that the internal is more certain than the external, the private is prior to the public. (Kenny 1966, 114)

Not only has privacy been substituted for rationality as the mark of the mental, but the mind with all its private contents is better known than any intersubjectively observable fact. The very title of the Second Meditation seems to support this since it suggests that the nature of the mind is easier to know than the body (the Latin has *notior*; and the French *plus aisé à connaître*).

But in what sense is the mind better known than the body? That the existence of the mind *qua* thinking is known *prior to* the body *qua* extended in the order of discovery that is part of the strategy of the *Meditations* does not in itself imply that it is better known in other ways. Whatever is known about the exercise of one’s cognitive capacities is known with the immediacy that the reflexive awareness involved

in actual thinking offers, and this immediate knowledge pertains to actual thinking alone. The reflexive awareness is seen as part of the act of thinking itself, not as a separate second-level thought act (AT V 220, CSMK 356–57; AT VII 175–76, CSM II 124). As such, this self-awareness of thought does not make an act of thinking clearer or more transparent than it is and should be distinguished from clear and distinct knowledge of the content of a thought that presupposes second-order reflection (cf. Broughton 2008, 188). In the case of sensations and **passions**, which are obscure and confused perceptions depending on the mind-body union, the mere self-awareness they involve is not by itself sufficient to make them clearer or more distinct (AT VIIIA 22, CSM I 207–8). Already within what could broadly be called a Cartesian tradition, Descartes' followers and critics were divided on what the human mind could know about itself, with **Malebranche** and **Spinoza** denying that it could have any distinct idea or cognition of self beyond the awareness of more or less confused sensory perceptions.

Descartes for his part argues that one cannot think without being aware or noticing that one thinks (AT VII 49, 246–47; CSM II 34, 171–72) but also that one is aware only of actual mental operations, not, for instance, of powers that are not exercised, or of thoughts passing in one's mind that are not retained or remembered and occur while sleeping or attending to other things (AT III 425, CSMK 190; AT III 478–79, CSMK 203; AT V 192, CSMK 354). If thought in Descartes' sense presupposes the capacity to attend to and reflect on one's thoughts and to render – to some extent, at least – their contents and interconnections clearer or more distinct, none of this can warrant the kind of transparency and self-evidence that the Rylean myth has bestowed upon it. Clear and distinct thought or perception is a norm or ideal and may, as Descartes thinks his experiment with systematic doubting has shown, be obtained as the outcome of sustained and focused intellectual attention and argument in certain privileged cases like “I think,” “I exist while I think,” and “ $2 + 2 = 1 + 3$ ” and, more controversially, in some of the other fundamental insights reached in the *Meditations*, like the existence of an omnipotent and perfect **God**, the notion of matter defined in terms of extension, and the proof of the real distinction between mind and body (cf. AT VIIIA 22, CSM I 207–8).

See also Certainty, Clarity and Distinctness, Faculty, Idea, Imagination, Intellect, Judgment, Mind, Perception, Reason, Sensation

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LILLI ALANEN

TIME

In the Scholastic tradition, time is distinguished from duration. Whereas duration is an **attribute** of things, time is the measure of **motion**, that is, a mathematical **quantity** measuring the duration of a process. This measure is obtained by comparing it with the duration of a motion assumed to be uniform, such as that of a clock or of the Sun. Descartes upholds this distinction, although he argues that, despite time's being called "the measure of motion," the duration involved in moving things is no different from that of things at rest (*Principles of Philosophy* I.57). "But in order to measure the duration of all things, we compare their duration with the duration of the greatest and most regular motions which give rise to years and days, and call this duration 'time.' Yet nothing is thereby added to duration, taken in its general sense, except for a **mode of thought**" (AT VIIIa 27, CSM I 212). Thus, duration is an attribute of things that is in the very things it is an attribute of; while time, when it is "distinguished from duration taken in the general sense and called the measure of motion, is simply a mode of thought" (27).

Moreover, Descartes, argues, the distinction between a particular **substance** and its duration is only a conceptual one, a distinction of reason (see **distinction [real, modal, and rational]**). The distinction between a substance and one of its

attributes is one of **reason** if the substance is unintelligible without that attribute. “Such a distinction is recognized by our inability to form a clear and distinct idea of the substance if we exclude from it the attribute in question.” For example, Descartes explains, “since a substance cannot cease to endure without also ceasing to exist, the distinction between a substance and its duration is merely a conceptual one” (AT VIIIA 30, CSM I 214).

These distinctions are essential to a correct understanding of Descartes’ proof of the **existence** of **God** from a consideration of “the nature of time” in the Third Meditation (AT VII 49, CSM II 33) or, as reexpressed, in the *Principles* I.2 1, “from the fact that our existence has duration” (AT VIIIA 13, CSM I 200) (see **cosmological argument**). The passage from the *Meditations* runs as follows:

I do not escape the force of these arguments by supposing that I have always existed as I do now, as if it followed from this that there was no need to look for any author of my existence. For since every lifetime can be divided into innumerable parts, each of which in no way depends on the others, it does not follow from my having existed a short while ago that I must exist now, unless there is some **cause** which creates me as it were again at this moment – that is, conserves me. For it is quite clear to anyone who attentively considers the nature of time that the same force and action is plainly needed to conserve any thing at each moment it endures as would be needed to create it anew if it did not yet exist.

Pierre Gassendi objected to this argument that the parts of time, far from being mutually independent or separable, form an “inviolable series and connection,” with the later parts depending on the earlier. Moreover, since the parts of time are “external, successive, and not active,” their dependence or independence on each other can make no difference to anything’s creation or conservation (AT VII 301, CSM II 209–10). In reply, Descartes accuses Gassendi of failing to heed the distinction between time as a continuous abstract quantity and concrete duration, the “duration of the enduring thing”:

And this is clearly demonstrated by what I explained about the independence of the parts of time, which you try in vain to evade by proposing *the necessity of the sequence which exists among the parts of time* considered in the abstract. It is not this that is at issue here, but rather the time or duration of the enduring thing, and you will not deny that the individual moments of this time could be separated from those next to them, that is, that the enduring thing could at any single moment cease to exist. (AT VII 369–70, CSM II 254–55)

This reference to the individual moments of duration (in contrast to the continuous sequence of instants in a continuous time) has led many interpreters to suppose that Descartes means that duration is made up of discrete moments, and that the continuous creation alluded to in the argument for the existence of a creator should be understood instead as a *discontinuous re-creation* of the world in successive atomic moments: the so-called classic thesis. Such an interpretation began with Descartes' immediate successors, such as **Louis de la Forge**, and immediately took root, as evidenced by the fact that both **Pierre Bayle** and **Gottfried Leibniz** assumed it to be the natural interpretation of Descartes' position. It was later advocated by Kemp Smith (1952) and defended (against J.-M. Beyssade's criticisms in 1971) by Martial Gueroult (1984).

There are strong reasons for doubting the classic thesis, however. First, it is in conflict with Descartes' views on **atoms** and indivisibles. To **Henry More** he writes that "it would imply a contradiction for there to be atoms which are conceived of as extended and at the same time indivisible" (AT V 273, CSMK 363). Applied to duration, this would preclude extended, indivisible moments. And in a letter to Mersenne of 1638, Descartes dismisses **Galileo's** composing of matter and lines "from an infinity of actual points" as "only an **imagination** pure and simple" (AT II 383). So it is no more likely that Descartes would countenance the composition of a continuous duration from durationless instants than he would a composition of extension from an infinity of extensionless points. Descartes refrained from trying to solve the problem of the composition of the continuum. But this gives us no reason to question his being committed to duration's being continuous, and there being instants everywhere in it, just as there are points everywhere in a continuous line.

Second, the interpretation of many proponents of the classic thesis as entailing an alternation of being and nonbeing is in direct conflict with Descartes' claim that a **substance** and its duration are only conceptually distinct, according to which "the duration of a thing simply [is] a mode under which we conceive the thing insofar as it continues to exist" (AT VIIIA 26, CSM I 211). This makes it impossible to attribute to him a view where a substance goes in and out of existence over time. Just as "it is a manifest contradiction for [bodies] to be apart, or to have a distance between them, when the distance in question is nothing" (AT VIIIA 51, CSM I 231), so will it be impossible for there to exist temporal gaps between any putative atoms of duration. Consequently, when More suggests that there could be duration between the destruction of one world and the creation of a new one, Descartes replies that this would imply a contradiction (AT V 343, CSMK 373).

It would seem prudent, therefore, to accept Descartes at his word when he writes of *continuous* creation: a substance – and, indeed, the whole world – is conserved in existence if at every instant of its duration God is exerting "the same **force**

and action” as was necessary to create it in the first instant. Because of the constancy and immutability of God’s action, “the world is continually conserved through an action identical with its original act of creation” (AT VIII A 66, CSM I 243). The motion that is conserved as a consequence “is not something permanently fixed in parts of matter, but something that is mutually transferred when collisions occur,” resulting in an overall conservation of the quantity of motion in the world.

The equating of conservation with continuous creation is, of course, a traditional doctrine, as Descartes reminds Gassendi in their exchange, something neglected by those who “attend only to **causes** of *coming to be*, but not to causes of *being*” (AT VII 301, CSM II 209). He gives the example of an architect or builder who causes a house to come to be, where the completed house “can remain in existence quite apart from the cause in this sense” – the same example used by **Saint Augustine** (*de Genesi ad litteram* 4.12.22), who adds: “The world could not last like this for the duration of an eyeblink if God were to withdraw his governance from it.”

Now, when God conserves a creature in being (*in esse*) by continuously creating it, according to Augustine he will be keeping in existence its *seminal reason*, from the actions of which its accidents will flow. But Descartes rejects such entities as seminal reasons and the **substantial forms** of the Scholastics. Thus, it was thought, Cartesian bodies have no power to act. This interpretation is a major motivation for the classic thesis; it was, of course, also one of the planks on which La Forge erected his Occasionalism (see **cause**). For if a **body** has no power of self-conservation and no power to act, La Forge maintained, it will not be able to cause other bodies to move but will simply be re-created by God at each successive moment together with its successive modes, including place. Descartes himself, however, wrote quite unqualifiedly about bodies having the power to act on other bodies. For from the fact that bodies have no power to conserve their own existence, it does not follow that they have no force or action; indeed, God conserves them in existence by endowing them with this very force and action. A body will have the motive force that it does provided God sustains the world by his creative action, but without this action, as Augustine and **Aquinas** maintained, the world and all the bodies in it would have no force and no continued existence.

See also Atom; Augustine, Aurelius; Cause; Divisibility; Force and Determination; Form, Substantial; Gassendi, Pierre; La Forge, Louis de; Motion

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RICHARD T. W. ARTHUR

TOLETUS, FRANCISCUS (FRANCISCO DE TOLEDO) (1532–1596)

Toletus was born in Spain into a family of humble origins, probably of Jewish or Moorish descent. He studied **philosophy** at Zaragoza or Valencia and theology at Salamanca. His professor of theology, Domingo De Soto, characterized him as an intellectual prodigy, and, indeed, by age fifteen Toletus held a chair in philosophy (Campbell 1921, 112–13). He entered the **Jesuit** order in 1558 and taught at the prestigious Collegio Romano in Rome, where future Jesuit teachers were trained. From 1559 to 1562 he taught philosophy there, and from 1562 to 1569, theology. From 1571 onward he was sent on various diplomatic missions, including one in 1596 to convert Henry IV of France (Schmitt and Skinner 1988, 838). Toletus became the first Jesuit cardinal in 1593 (Van Ackeren 2003, 102). His accomplishments were both political and intellectual. In 1595 he persuaded Pope Clement to grant Henry IV absolution, which established peace in France (Campbell 1921, 113). He also left behind numerous writings, including influential commentaries on Aristotle's *Physics*, *De Anima*, and *De Generatione et Corruptione* and on Saint Thomas's *Summa Theologiae* (Schmitt and Skinner 1988, 838).

Descartes was familiar with at least some of Toletus's works. On September 20, 1640, he wrote to **Marin Mersenne**, expressing a desire to reacquaint himself with the Scholastic philosophy of his youth in anticipation of objections to his *Meditations on First Philosophy*. Enlisting Mersenne's help, Descartes writes, "I only remember some of the **Conimbricenses**, Toletus and **Rubius**" (AT III 185, CSMK 154). While we do not know exactly which textbooks Descartes studied at the Collège de la Flèche, Toletus's Commentary on Aristotle's *Physics* is fairly representative. In standard commentary format, it follows the order of the Latin edition of Aristotle's *Physics*, which was divided into books, chapters, and texts. Toletus gives a comprehensive explanation of each text and then handles some standard questions. He usually gives a complete overview of all the opposing positions on a certain issue but summarizes the arguments very concisely rather than giving details.

See also Conimbricenses; Jesuit; Rubius, Antonius; Scholasticism

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HELEN HATTAB

TRANSUBSTANTIATION

The miracle of the Eucharist is that in Holy Communion the **substance** of the bread and wine is removed and is replaced by the substance of Christ's flesh and blood. Coextensive with this, the sensory accidents of Christ's flesh and blood are removed, and the accidents of the bread and wine (their color, taste, odor, smell, and feel) remain. The miracle then consists not merely in the replacement of the substances of bread and wine with the substances of Christ's flesh and blood but also in the removal of the sensory accidents of Christ's flesh and blood and the substitution of the sensory accidents of bread and wine. These sensory accidents of bread and wine are unsupported by any substance, for if they were supported by the substances of Christ's flesh and blood that they now conceal, then those substances would *be* bread and wine. In Aristotelian terms, this involves two miracles. The first miracle is

the **existence** of the substantial forms of Christ's flesh and blood without their sensory accidents, and the second miracle is the presence of the sensory characteristics of bread and wine separate from their substantial forms and, moreover, separate from any supporting substantial form at all (see **form, substantial**).

There is also the big-little problem. How can a large volume of Christ's **body** occupy the space of a small piece of bread, and Christ's blood occupy the small space of a bit of wine? On the other hand, how can the small volume of Christ's body and Christ's blood be enough to occupy the large quantities of consecrated bread and wine required when many people are given communion at the same time?

Descartes argued that the Aristotelian **physics** of substantial forms and accidents is nonsense. He wrote to **Mersenne** that "there will be ... no difficulty in accommodating theology to my way of philosophizing because there is nothing to change except for transubstantiation, which is extremely clear and easy according to my principles" (AT III 295–96, CSMK 172). Mersenne did not take the hint to construct a Cartesian **explanation** of the Eucharist, so Descartes did it himself.

Descartes' explanation of transubstantiation is based on his view that material bodies are nothing other than portions of three-dimensional space that retain their size and **shape** when moved about. These material bodies have no sensory properties, but only three-dimensional geometrical properties. The sensory properties we attribute to bodies are merely **sensations** or mental properties whose function is to guide our actions in the world of bodies.

The church's explanation of the Eucharist requires the multiple miracles of the substantial forms of bread and wine being removed, Christ's flesh and blood replacing them, and the real sensory properties of bread and wine remaining after the substantial forms of bread and wine are removed. Thus, in Aristotelian terms these sensory properties exist without substantial support. But on Cartesian principles, all that is required is that the surfaces of Christ's flesh and blood be rearranged to **cause** us to perceive them as though they were bread and wine. This disposes of sensory properties of bread and wine existing miraculously without any underlying substantial form to support them. It disposes also of the problem of the substantial forms of Christ's body and blood existing without causing sensory properties. All that is required is that God substitute the substances of Christ's flesh and blood for the substances of bread and wine, while retaining on Christ's flesh and blood the same superficial patterns that were on the bread and wine. This is a Cartesian mechanistic explanation of how the miracle is effected that does not require Aristotelian substantial forms existing without manifesting their sensible properties.

Descartes' proposal does not dispose of the miracle of the replacement of bread and wine with Christ's flesh and blood or with the miracle of the reorganization of the superficies of Christ's flesh and blood so they produce in us the sensations of bread and wine. It does, however, dispense with the miracle of Aristotelian substantial forms existing without producing any sensory properties at all, even though

the sensory properties they do support are not the ones they naturally produce. Descartes' proposal was calculated, therefore, not to eliminate the miracle but to eliminate substantial forms.

A serious problem with this superficies reorganization, however, is that what a Cartesian body is, is entirely a function of its three-dimensional structure, that is, its **extension** configured by the modes of extension (size, shape, **motion**). As a result of this structure, it produces distinctive sensory appearances, in this case, those that we associate with bread and wine. But whatever causes sensory perceptions of bread and wine actually is bread and wine.

This may be the reason why, when **Denis Mesland** inquires about the details, Descartes gives an explanation entirely different from the preceding one. Now he says that when we eat bread and drink wine, the particles produced become parts of our flesh and blood. This is natural transubstantiation. Thus "the numerical unity of the body of a man depends not on its matter but on its [geometrical, not substantial,] form" (AT IV 346, CSMK 279). In the Eucharist, then, there is no necessity for bread and wine to be removed and replaced by the actual flesh and blood of Christ. All that is required is that Christ's soul be supernaturally joined with the bread and wine. By such union, the bread and wine become part of Christ's flesh and blood, just as particles of bread and wine through ordinary digestive processes become parts of the flesh and blood of anyone who eats and drinks that bread and wine. This ingenuous mechanistic explanation, however, is dangerously close to Lutheran and Calvinist notions of the real presence of Christ in the Eucharist. Descartes himself did not remain happy with it, for he later combined his two theories by saying that after Christ's flesh and blood replace the bread and wine under the same superficies as the bread and wine had, then, also, Christ's soul is united with this breadlike and winelike manifestation of Christ's flesh and blood (AT IV 372–73, CSMK 284). Mesland was ordered to cease writing on the subject and was sent as a missionary to the New World where he died. Descartes had enough sense to abandon the issue.

Later Cartesians were not so wise. Pierre Cally (1630–1709), **Robert Desgabets** (1610–78), and Emmanuel Maignan (1601–76) proposed Cartesian explanations of the Eucharist, and all had church sanctions imposed upon them.

See also Body; Faith, Religious; Form, Substantial; Mesland, Denis; Quality, Real; Sensation

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RICHARD A. WATSON

TREATISE ON MAN

The *Traité de l'homme* was first published in its original French by **Clerselier** (*L'homme*, 1664), after being published in a Latin translation by Florent Schuyl (1619–69) (*De homine*, 1662 and 1664). Apart from a short summary in the *Passions of the Soul* (art. 7–16) and the equally posthumous *Description of the Human Body*, this work is the main source of Descartes' physiology. A "treatise on man" was planned by Descartes as early as 1629, as part of an **explanation** of "all natural phenomena, that is, all of **physics**" (AT I 70, CSMK 7), as indicated by the summary of the "treatise on light" in the *Discourse on Method*. According to that summary, the treatise would contain a discussion not only of celestial and terrestrial **bodies** but also of man "because he observes them" (AT VI 42, CSM I 132). Not only is the inclusion of "human nature" in accordance with the traditional conception of physics, but it also matches Descartes' statement in 1645 that he started work on a "treatise on **animals**" (which is clearly what we now know as his *Treatise on Man*) "more than fifteen years ago" (AT IV 326).

Descartes' approach raised the challenging problem of how to integrate a theory of man into his own theory of nature, given the fact that the human **mind** cannot be reduced to matter; and he could not speak of living bodies "in the same manner as the other things, that is, by demonstrating effects from causes and showing from what seeds and in what manner nature must produce them" (AT VI 45, CSM I 134). The first problem could be solved by giving the human mind an exceptional status; the second problem could be solved only by means of the "supposition" that "**God** formed the body of a man exactly like our own ... using for its composition nothing but the matter that I had described," without placing in it

any rational soul or any other thing to serve as a vegetative or sensitive soul, but rather that he kindled in its **heart** one of those fires without **light** which I had already explained, and whose nature I understood to be no different from that of the fire which heats hay when it has been stored before it is dry. (AT VI 46, CSM I 134)

Accordingly, the explanation of vital phenomena would as yet have to be *a posteriori* and consist in assigning a hypothetical **cause** to an observed effect. In terms of Aristotelian logic that would mean that physiological explanations are not truly scientific. It may have been for that reason that in the summer of 1632 Descartes considered the possibility of including a description of “how animals are generated,” that is, how humans and animals are formed from a proximate cause, deciding in the end against it because “it would take too much time” (AT I 254, CSMK 59). At that point, all Descartes still had to do was “to add something on the nature of man” (AT I 254, CSMK 59). More particularly, he still had to explain **imagination**, **memory**, and presumably the **passions** (AT I 263, CSMK 40).

Actually, the text Descartes was about to send to **Mersenne** at the end of 1633 constituted no more than the first half of the planned “treatise on light” and contained nothing on animals or men (AT I 270–72, CSMK 40–41). It is from that point that the fates of what came to be known as *The World* (on general physics and **cosmology**) and the *Treatise on Man* become separated. Descartes shelved *The World* but, according to a later letter (1646), the manuscript of the part on animals and men was lent to “a close friend, who made a copy which was then recopied by two more people, with my permission but without my rereading or correcting,” despite the fact that it was covered with so many notes that he could hardly read it himself (AT IV 566–67, CSMK 301). Once those copies were made Descartes seems to have left the text alone. The fact that the Dutch and French editors used different manuscripts raises questions with respect to the text and the illustrations. Descartes intended to illustrate his treatise with numerous figures but drew only two sketches himself. As a consequence, the illustrations in the French and Dutch editions, which were added by the editors on the basis of their understanding of the text, are also significantly different.

See also *Anatomy and Physiology, Animal, Explanation, Heart, Human Being, Machine, Perception, Pineal Gland, The World*

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THEO VERBEEK AND ERIK-JAN BOS

TRUE AND IMMUTABLE NATURE

Like many philosophers, Descartes draws a distinction between the **existence** of a thing and its **essence** or nature. Even if an entity does not exist, presumably there is still a fact about what the entity would be like if it did exist. Sometimes Descartes speaks of an essence as an **idea** that is before a **mind** when it is thinking of an object (AT VIIIa 27–28, CSM I 212–13; AT IV 348–50, CSMK 279–81). Descartes also speaks of the essences as things that exist independently of our ideas of them – for example, when he discusses existing objects and the essences that constitute them (AT IV 348–50, CSMK 279–81). For Descartes, an essence or nature can exist in thought, and it can also exist in reality or in *re*.

Descartes introduces the notion of a true and immutable nature in the Fifth Meditation. One of the central goals of this meditation is to provide an additional argument for the existence of **God**, and Descartes sets up that argument by engaging a discussion of truths about triangles and other geometrical figures (see **ontological argument**). More specifically, he notices that there are "ideas of things which even though they may not exist anywhere outside me still cannot be called nothing" (AT VII 64, CSM II 44). The reason they cannot be called nothing is that "various truths can be demonstrated of them" – for example, that the three angles of a triangle add to two right angles, and that the longest side of a triangle subtends the triangle's greatest angle. Such truths "are not my invention" for we "clearly recognize [them] whether we want to or not" (AT VII 64, CSM II 44–45). There is something that we are picking out when we demonstrate a result about a triangle, an entity that puts constraints on what we can truly think about triangles and what we cannot.

Triangular figures may not exist, but the fact that we recognize truths about them entails that triangles are “not merely nothing” but “have their own true and immutable natures” (AT VII 64–65, CSM II 44–45).

An interpretive question arises almost immediately concerning the ontological status of these natures – whether they are entities that exist only in idea, entities that exist independently of ideas, or both. This question arises in the light of the striking claims that Descartes makes about natures in the Fifth Meditation: they do not depend on our minds; they exist even if perhaps the objects that have them do not; and they are eternal (AT VII 64, CSM II 45). Elsewhere he says that essences are creatures of God (AT I 152, CSMK 25).

Commentators have made numerous attempts to make sense of the ontological status of true and immutable natures in a way that squares with all of the texts and also the relevant systematic tenets. On one view, defended most prominently by Anthony Kenny (1968, 155–56; 1970, 692–93), true and immutable natures are third-realm Platonic entities that occupy a status somewhere between being and nonbeing. Part of the motivation for Kenny’s interpretation is to make sense of how Descartes takes the existence of the true and immutable nature of God to be evidence for the existence of a mind-independent thing. The interpretation can account for the datum that true and immutable natures are creatures, and for the claim that they exist even if perhaps the objects that have them do not. It also allows Descartes to hold that not all essences are instantiated and that, even when a thing does not exist, there is a fact of the matter about what the thing would be like if it did exist. Kenny’s view can also make sense of Descartes’ claim that true and immutable natures do not depend on our minds, as they occupy a mind-independent third realm. A potential problem for Kenny’s view is that it has to downplay Descartes’ claim that true and immutable natures are eternal. However, in some passages Descartes unpacks the eternality of essences in terms of their immutability (AT VII 381, CSM II 262). Another potential problem for Kenny’s view is that it might appear to posit entities that Descartes’ sparse dualistic ontology would not sanction (AT VIIIA 22–23, CSM I 208–9; Nolan 1997, 171).

On another view, defended most prominently by Tad Schmaltz (1991, 135), true and immutable natures are divine decrees by which God specifies the criteria that a thing has to meet in order to be a thing of a certain kind. What it is to be a triangle is to be a bounded three-sided figure, and Descartes, as a voluntarist, is committed to the view that what it is to be a triangle (and what it is to be anything else) is decided by God. Schmaltz’s view allows a literal reading of Descartes’ view that true and immutable natures are immutable and eternal. In addition, the view squares with Descartes’ claim that the true and immutable nature of a thing would exist even if perhaps the thing did not, if God creates a number of natures that he does not actualize. A potential problem for Schmaltz’s view is that it has to deny that all essences are creatures, or it has to allow that God and his creation in some cases coincide.

Another potential problem is that there is scant textual evidence for the view that true and immutable natures are divine decrees. It must be emphasized, however, that there are only a few isolated passages in which Descartes speaks of true and immutable natures. Outside of the Fifth Meditation, he speaks of them very briefly in the First Replies (AT VII 115–16, CSM II 82–83), Fifth Replies (AT VII 380–81, CSM II 261), *Principles* I.15 (AT VIIIA 10, CSM I 198), and *Conversation with Burman* (AT V 160, CSMK 343). Schmaltz (1991, 137–39) emphasizes that the view that he is attributing to Descartes is present in the work of some of Descartes' most important contemporaries, for example, **Francisco Suárez**, and that it might have been regarded as standard fare.

On a third view, defended most prominently by Lawrence Nolan, true and immutable natures are entities that exist in finite minds. Nolan (1997, 179–80) argues more specifically that true and immutable natures reduce to innate ideas considered with respect to their objective reality or content. The textual evidence for this view includes Descartes' claim in the Fifth Meditation that the true and immutable nature of a triangle "cannot be called nothing": in the Third Meditation he had used the same **language** to describe the objective reality of an idea, which he says is "certainly not nothing," even if it is inferior to formal being, which things like tables and chairs possess (AT VII 41, CSM II 29) (see **being, formal versus objective**). Another piece of evidence for Nolan's view is that at the start of the Fifth Meditation Descartes has not established once and for all that God exists and so has not yet overcome the hyperbolic **doubt** of the First Meditation. Accordingly, he cannot confidently posit the existence of anything other than his mind and its ideas, and so true and immutable natures must be among the latter. Nolan's view can account for the datum that true and immutable natures do not depend on finite minds: it is not up to a finite mind to manipulate the content of an innate idea; that has been fixed by God. Nolan's view can also make sense of the datum that true and immutable natures are creatures, and it can understand the eternity of true and immutable natures in terms of their immutability. Nolan's view can also allow that there are essences that are not instantiated. A potential problem for this account is that there is some controversy about whether Descartes' **cosmological arguments** in the Third Meditation arguments are sufficient to dissolve hyperbolic doubt. On one reading, the Fifth Meditation argument is meant to defeat hyperbolic doubt once and for all, but on another reading it is meant as an additional proof for meditators who did not completely follow the arguments that came earlier (AT VII 120, CSM II 85; AT VII 163–64 and 136, CSM II 115 and 97–98; Cunning 2008, 220–21). Another potential problem for Nolan's view is that Descartes' claim that true and immutable natures have some ontological status is not the claim that ontologically speaking they amount to objective reality.

On a fourth view, defended most prominently by David Cunning, true and immutable natures are the truth makers of true claims about geometrical figures (or

God and other entities). On this view, in the Fifth Meditation the meditator appeals to his intuition that **truth** is the conformity of ideas with reality (AT VII 37–38, CSM II 26; AT II 597, CSMK 139) and concludes that there is some reality in virtue of which true claims about geometrical figures are true. The meditator does not yet recognize that there exists an extended universe that “possess[es] all the properties which ... are comprised within the subject-matter of pure mathematics” (AT VII 80, CSM II 55), and so he does not recognize that the true and immutable natures of geometrical figures are the properties of objects that make geometrical truths true. Descartes speaks of essences insofar as they exist in idea and also insofar as they exist in the objects that have them; on Cunning’s view, true and immutable natures are the latter. This view can do justice to Descartes’ claim that something is secured by the truths of **geometry** – in effect, a truth maker. This view also squares with the claim that true and immutable natures do not depend on finite minds and is consistent with saying that essences are creatures. It also allows for the Fifth Meditation to be making a significant advance on the Third Meditation: in the latter, the meditator brackets the question of whether his ideas are true or false, but for each idea he has, he can still draw the conclusion that there exists some objective reality; in the Fifth Meditation the mediator is drawing the more robust conclusion that true ideas guarantee the existence of a thing that conforms to it. One of the potential problems for Cunning’s view is that it assumes that geometrical properties exist formally in bodies, but Descartes appears to hold that actual bodies are far less perfect (AT VII 381–82, CSM II 262). Another problem for Cunning’s view is that it supposes that Descartes’ meditator is not yet a full-blown Cartesian even as late as the Fifth Meditation.

See also Being, Formal versus Objective; Essence; Eternal; Truth; Existence; God; Idea; Ontological Argument

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DAVID CUNNING

TRUTH

In the Third Meditation, Descartes distinguishes two main subclasses of "**thoughts**": "**ideas**," which are "as it were images of things," and others, "thus when I will or am afraid, or affirm or deny" (AT VII 37, CSM II 25–26). The latter, "**judgments**," "can properly be said to be the bearers of truth and falsity." Descartes will later call this kind of falsity "formal falsity" (AT VII 43, CSM II 30). He goes on to say that, "as far as ideas are concerned, provided they are considered solely in themselves and I do not refer them to anything else, they cannot strictly speaking be false." Thus, it is only judgments "where I must be on my guard against making a mistake." If we suppose that Descartes also means that ideas cannot properly speaking be true, then we have a bifurcation thesis: some thoughts can be the bearers of truth and falsity (properly understood); others cannot. Call this the "standard view." The standard view also comes with an explanation for the bifurcation. Since only propositions can be true or false and since judgments are expressed by statements with propositional clauses (e.g., "I judge that **God** exists") and ideas are expressed by phrases with term structures (e.g., "an idea of God"), judgments can be true or false, but ideas cannot be.

There are some difficulties with the standard view. For one thing, when in the Fourth Meditation, Descartes explains the difference between judgments and ideas, he does not mention a distinction between term expressions and proposition expressions but says that judgments are active events, falling on the side of the will, and ideas are passive events, falling on the side of **perception** (AT VII 56, CSM II 39). For another, there are several categories of texts in which Descartes attributes truth to items that fall on the side of perceptions rather than judgments. One of the most important of these is where Descartes asserts his "rule of truth," for example, in the second paragraph of the Third Meditation: "Whatever I perceive very clearly and distinctly is true." If perceptions are not judgments, how can they be true? The

answer that the standard view offers is that they can be true if the content of the clear and distinct ideas is a proposition, which in this case it is: “I am a thinking thing.... In this first item of knowledge there is simply a clear and distinct perception of what I am asserting” (AT VII 35, CSM II 24) (see Wilson 1978, 141, and Wahl 1995). But it is not always so. Clear and distinct perception is often given a term expression by Descartes, and the standard view ignores the way that Descartes himself distinguishes bearers of formal truth and falsity from nonbearers (see **clarity and distinctness**).

Naaman-Zauderer (2010, 28–29) has recently offered an alternative to the standard view. This position takes as a central text a letter to **Mersenne** in which Descartes gives a general account of what the word “truth” means: “The word ‘truth’ in the strict sense, denotes the conformity of thought with its object” (AT II 597, CSMK 139). If we take “thought” in the narrow sense here as equivalent to “idea,” as she does, we have the doctrine that there are two notions of truth in Descartes: truth *simpliciter*, understood in an “ontological sense” as “conformity of an idea with its object,” and “formal truth,” truth understood in a nonontological sense, assigned to acts of judgment correctly performed (on the basis of clear and distinct ideas). Correspondingly, “formal falsity” is understood in a nonontological sense as an attribute of acts of erroneous judgment (those applying to confused or obscure ideas).

One of the important features of this view is that it requires a narrow reading of “thought” in the passage just quoted, rather than the broad reading Descartes gives it in the passage from the Third Meditation quoted previously. Since a narrow reading is not specifically asserted in this text, the case for seeing two notions of truth in Descartes needs to be buttressed by considering other categories of texts (see Naaman-Zauderer 2010, 22–38). One concerns the “**material falsity**” of ideas of sense (AT VII 43–44, CSM II 30). Although Descartes does not himself use the **language** of “material truth” in connection with ideas, some commentators have “extrapolated” the second concept, leading to a bifurcation between two kinds of truth: formal truth and falsity (applicable to judgments) and material truth and falsity (applicable to ideas) (Flage and Bonnen 1999, 25). However, there is some reason to think that material falsity denotes a defect in the sensory ideas themselves, a certain obscurity perhaps, rather than a relation of nonconformity between ideas and their object (see AT VII 234, CSM II 164). If so, the proposed extrapolation would not yield a concept fitting Descartes’ characterization of truth in general as the conformity of ideas with their object. We need to look elsewhere.

Recall that on the standard view, the bifurcation of thoughts into those given proposition expression and those given term expression is of fundamental significance for Descartes. However, there are indications in a letter to Mersenne of July 1641 that Descartes himself may not think so (see Wahl 1995, 190–92). Speaking there of the difference between proposition expression and term expression of

ideas of the **mind** versus ideas of the **imagination**, he says that “they both can be expressed in either way” (AT VII 395, CSM II 186). Later in this letter he explains the relationship between these two ways: “The idea we have of God ... is quite different from the proposition, ‘God exists,’ so that then one can serve as the means or premise to prove the other” (AT III 396, CSMK 186). If a certain proposition-expressed idea is derived from a term-expressed idea, and the former is true, we would expect a form of truth for term-expressed ideas too. Indeed, we do find this for the term-expressed idea of God in the Third Meditation (“This is enough to make the idea of God the truest and most clear and distinct of all my ideas” [AT VII 46, CSM II 32]). (For a suggestion about how proposition-expressed ideas are derived by Descartes from term-expressed ideas, see Vinci 1998, 223–25.) Correlatively, if we are still understanding truth in general as the conformity of thought with object, we would expect to find two kinds of conformity: one for proposition-expressed ideas, one for term-expressed ideas. In fact, this is what we do find.

Consider again Descartes’ rule for truth: “Whatever I perceive very clearly and distinctly is true.” Notice that Descartes could have reformulated his position without mention of truth: *if I have a clear and distinct idea that p, then p*. Indeed, in the Fourth Replies he gives just such a formulation: “From the fact that I am aware of nothing else belonging to my **essence** ... apart from the fact that I am a thinking thing, it follows that nothing else does in fact belong to it” (AT VII 219, CSM II 154). This rule treats truth as a kind of conformity between proposition-expressed ideas (*the clear and distinct perception that p*) and its object (*that p*), but it treats the word “truth” itself as redundant, making it a version of the redundancy theory of truth. This is the conformity of *proposition-expressed ideas* with their objects.

For an account of truth as the conformity of *term-expressed ideas* with their objects, we must look to another letter to Mersenne (AT III 544–45, CSMK 211). There, Descartes proposes an equivalence between “whatever we perceive clearly is true” and what amounts to a statement of his Causal Principle: “The objective reality of our ideas needs a **cause** which contains this reality not merely objectively but formally or eminently” (AT VII 165, CSM II 116). Leaving a detailed argument for this equivalence to another place (Vinci 1998, 42–48, 84–87), let us note two important points. The first is that the mention of ideas in the phrase “the objective reality of ideas” is a term expression of ideas, and the second is that formal and eminent *containment* of the objective reality of ideas is a kind of *conformity* of ideas with an object, in this case, their cause (see **being, formal versus objective** and **containment, eminent versus formal**). Here, however, the conformity is achieved not by making the truth predicate redundant but by defining “conformity” in metaphysical terms.

See also Cause; Clarity and Distinctness; Falsity, Material; Idea; Judgment

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THOMAS VINCI

UNIVERSAL

One of the major intellectual debates of the Middle Ages concerned the problem of universals. The problem has its source in Plato and Aristotle, but medieval philosophers such as Boethius, Abelard, **Aquinas**, **Scotus**, and Ockham discussed it with a degree of precision and sophistication that is perhaps unrivaled. It is sometimes noted that there is not one problem here but several, touching on metaphysical, epistemological, and logical questions. The main problem, however, is metaphysical and can be stated as follows: some things in the world resemble each other. Many things are, for example, red, six feet tall, virtuous, and/or human. If two or more things are similar in one of these respects, or in some other respect, in virtue of what are they similar? Is there some entity that they literally share in common – namely, the universal (such as Redness)? If so, what status does this universal have? Does it exist *in* particulars, or is it distinct and separable from them? Broadly speaking, “realists” are philosophers who affirm the **existence** of universals and confer some ontological status upon them apart from the **mind**, whereas “conceptualists” and “nominalists” – for reasons of ontological parsimony – reduce them to **ideas**, names, or even the spoken word. In the Middle Ages, the debate about universals centered on Aristotle’s five “predicables” – genus, species, differentia, property, and accident – that had been treated in an influential work by Porphyry, a third-century Neoplatonist. What, for example, is the ontological status of the species man, or of rationality, which constitutes the differentia that distinguishes man from other species within the genus animal? But for philosophers before and after this period, the problem of universals has always had a much wider application. Plato, for example, was a realist who conceived of Beauty, Truth, and mathematical objects as separately existing universals.

Most early modern philosophers write as if the problem of universals has been solved and typically give the issue only passing attention. When modern philosophers address the issue, they tend to gravitate toward a form of conceptualism or nominalism, insisting that only particulars exist and that universals are merely ideas or general terms, apparently taking their inspiration from the nominalist movement of the late fourteenth century. It is against this backdrop that one must understand Descartes’ brief but important discussion of universals. Whereas medieval philosophers wrote volumes on the topic, Descartes writes only a few pithy remarks. But precisely because he writes so little and what he says appears in different contexts, his account has been the subject of intense scholarly dispute.

The conceptualist character of Descartes’ account of universals is unmistakable, but from his earliest writings he is acutely aware of the seductive power of various forms of realism. For example, in the *Rules for the Direction of the Mind* (written in the 1620s) he notes that when engaged in arithmetic or **geometry** one

treats mathematical objects such as number in **abstraction** from actually existing things. The danger is that one tends to reify these mental abstractions, that is, to treat them as real entities in their own right apart from particulars. “Those who attribute wonderful and mysterious properties to numbers do just that. They would surely not believe so firmly in such sheer nonsense, if they did not think that number is something distinct from things numbered” (AT X 445–46, CSM I 61). This early remark helps to explain a similar comment in the *Principles of Philosophy* (1644):

We shall ... have a very distinct understanding of *duration*, *order* and *number*, provided we do not mistakenly tack on to them any concept of substance. Instead we should ... not regard order or number as anything separate from the things which are ordered and numbered, but ... simply as modes under which we consider the things in question. (AT VIIIA 26, CSM I 211)

Here again we find Descartes warning his readers about the temptation to reify mental abstractions. This warning helps prepare them for his positive view that universals are merely ideas, as he explicitly states only a few sections later:

Number, when it is considered simply in the abstract or in general, and not in any created things, is merely a mode of thinking [*modus cogitandi*]; and the same applies to all the other *universals*, as we call them.

These universals arise solely from the fact that we make use of one and the same idea for thinking of all individual items which resemble each other.... When we see two stones, for example, and direct our attention not to their nature but merely to the fact that there are two of them, we form the idea of the number which we call “two”; and when we later see two birds or two trees, and consider not their nature but merely the fact that there are two of them, we go back to the same idea as before. (AT VIIIA 27, CSM I 212)

In the continuation of this passage, Descartes takes an official stand on the Scholastic debate by asserting that the five Aristotelian predicables mentioned earlier in this entry reduce to ideas in the same way. These passages constitute Descartes’ most definitive statement of the ontology of universals, not only because they appear in one of his most mature works but also because they occur in one of the few places in the corpus where he outlines his **metaphysics** in a systematic way. They are foreshadowed in *Principles* I.48, where we are told that **eternal truths** have “a seat within our mind” (AT VIIIA 23, CSM I 209; cf. AT I 145, CSMK 23). This is significant since in his early **correspondence** Descartes identifies eternal truths with universal **essences** (AT I 152, CSMK 25), which means the latter must have a seat within the mind too (see Chappell 1997, Nolan 1997a).

Now one commentator, Alan Gewirth, reads these long passages (*Principles* I.58 and 59) not as endorsing conceptualism but as agreeing with Aristotle that universal mathematical objects inhere in particular substances as what Descartes calls **attributes** or **modes**. Gewirth (1971, 289–90) also concludes that Descartes offers “an Aristotelian conception of the way in which men acquire their ideas of numbers and figures by abstraction from empirically observed particulars.” But as Descartes makes clear elsewhere, the expression “modes of **thought**” means not modes in the strict sense (i.e., modes of things) but rather “ways of thinking” (AT IV 348–49, CSMK 280). Thus, in calling universals *modi cogitandi* he means to say only that they are ideas in human minds. Descartes also makes explicit in this latter passage that we come to think of universals by means of *intellectual* abstraction, not by abstracting from sensible particulars. His examples of stones, birds, and trees in the preceding passage are intended merely to make the general point about how universal ideas are formed clearer to his reader, whom he takes to be a Scholastic empiricist (for further discussion, see Nolan 1997b and 1998).

To fully appreciate Descartes’ conceptualism, it helps to understand its underlying motivation. The problem of universals concerns the ontological status of properties (or, more generically, “affections”) of **substances**. In order for universals to be “real” in the sense of having being outside the human mind, they would have to be properties of created substances or exist in some third realm such as the mind of **God**. And if they existed in created substances, they would have to be shared by two or more substances; the *very same property* would have to be multiply instantiated simultaneously. But, as will become clear in what follows, Descartes holds that there is a very intimate relation between a substance and its affections, so intimate in fact that realism is barred to him.

Descartes recognizes two and only two types of affection – attributes and modes. When speaking loosely, he sometimes uses these terms interchangeably, but when setting out his theory of distinctions in the same series of articles from the *Principles* already cited, he treats them as mutually exclusive. He then proceeds to characterize each of them. In I.62, we are told that a substance and any one of its attributes are merely rationally (or conceptually) distinct. Attributes in this strict sense include duration, number, and the essence or “principal” attribute of a substance (**thought** in the case of mind and **extension** in the case of **body**). The import of this discussion is that the distinction between a substance and its attributes obtains solely within our thought; in reality there is no such distinction, as Descartes makes clear in the subsequent article, when characterizing the relation between a substance and its essence: “Thought and extension ... must ... be considered as nothing else but thinking substance itself and extended substance itself – that is, as mind and body” (AT VIIIA 30–31, CSM I 215; cf. AT IV 350, CSMK 280) (see **distinction [real, modal, and rational]**). The same account applies to the relation between a substance and its number

(or unity), which was the topic of some of the passages considered earlier. When Descartes says that number is not distinct from the thing numbered he is claiming that a substance just is *its* number. Given the identity that obtains between a substance and any one of its attributes, Descartes cannot say that an attribute is common to several substances in any literal sense, as the realist would have it. Nor can he say this of modes in the strict sense, given his view that a mode is just a way of being an extended or thinking thing, and thus is unique to that thing. In fact, in defining a modal distinction in the *Principles* I.61, Descartes insists that the modes of two substances are as really distinct as the substances themselves (AT VIIIA 30, CSM I 214). Thus, as much as the mode of one substance (say the shape of a body) may resemble the mode of another, they cannot be numerically identical.

Clearly, there is no room within Descartes' austere substance-mode ontology for universals to exist in created things. But what about the other realist alternative? What if they existed separately, apart from both our thought and created substances? Despite the strong conceptualist message of the passages considered earlier, some commentators have read Descartes as holding a Platonic or quasi-Platonic account of the ontology of universal essences. One version of this reading, advocated by Anthony Kenny, takes its bearings from some of Descartes' remarks about "**true and immutable natures**" in the Fifth Meditation. There, in the context of setting out the **ontological argument** for God's existence, he writes:

I find within me countless ideas of things which even though they may not exist anywhere outside me still cannot be called nothing; for although in a sense they can be thought of at will, they are not my invention but have their own true and immutable natures. When, for example, I imagine a triangle, even if perhaps no such figure exists, or has ever existed, anywhere outside my thought, there is still a determinate nature, or essence, or form of the triangle which is immutable and eternal, and not invented by me or dependent on my mind. (AT VII 64, CSM II 44–45)

Descartes clearly uses Platonic language in this passage when he speaks of the "nature, or essence, or form of the triangle," and the suggestion that a triangle does not depend on my mind and has being even if there are no triangles in the world led Kenny (1970, 692–93) to crown Descartes as "the father of modern Platonism." Kenny's full thesis is that universal essences are created by God but enjoy a separate and attenuated form of existence apart from created substances and from our thought. Because he recognizes that Cartesian essences are created (given divine voluntarism, i.e., the doctrine that everything depends on God's will), Kenny stops short of placing them in God, but other commentators have done just that. For example, in an effort to explain how Cartesian essences can be "immutable and

eternal,” Tad Schmaltz (1991) identifies them with divine decrees. More recently, Marleen Rozemond (2008) argues that in order to account for divine **knowledge** of creatures, Descartes holds a view like Scotus and takes universal essences to have objective being in God’s mind.

One general problem with all three of these interpretations is squaring them with the explicit conceptualism in the *Principles*, which expresses Descartes’ most authoritative views on the matter. Kenny’s reading, in particular, is based on the Fifth Meditation (and similar remarks in the *Discourse on Method*), but there are ways of reconciling that text with the conceptualist interpretation. Descartes may be invoking Plato in that context only because he is borrowing the theory of innate ideas. Descartes believes, like Plato, that our ideas of mathematical objects are innate and wants to extend this point to our idea of God. And, in fact, Descartes explicitly invokes the Platonic doctrine of recollection just before the passage cited earlier. Kenny’s reading is motivated in part by Descartes’ claim that universal essences are “not ... dependent on my mind,” but it is clear from the larger passage that what Descartes means is that, as innate ideas, essences do not depend on the mind for their content in the way that invented or factitious ideas do. We can think of them at will, but we cannot alter them at will. In general, the claim that universal essences are merely innate ideas fits better with the themes of the *Meditations* than Kenny’s Platonist interpretation. As a thinking thing, the meditator is certain that he has ideas, but it would constitute an egregious violation of the **method** of **doubt** for him to presuppose the existence of third-realm entities (Nolan 1997a, 171).

The attempt to identify universal essences with divine decrees has other problems. First, Descartes holds that essences or eternal truths are created by God, but it would be peculiar to hold that divine decrees are created. How are they created if not by higher-order decrees? This invites an infinite regress. Second, any attempt to locate created essences in God faces the charge of heresy, insofar as it identifies God with his creation and thus denies his transcendence. Third, how can there be a multiplicity of diverse essences in God given the traditional Christian doctrine of divine simplicity that Descartes understood very strictly?

In the Middle Ages, one could consistently deny that universals are *in* things while also holding that they have being in the divine mind *qua* ideas or archetypes for creation. Universals in the latter sense were called *universalia ante rem* (“universals before the thing,” i.e., prior to creation) (see, e.g., Klima 2013). This tradition forms the basis of Rozemond’s interpretation. She suggests that Descartes’ conceptualist remarks in the *Principles* are intended to address only the status of universals in the created world (*universalia in re*) and thus do not foreclose the possibility that he locates essences in God. If correct, this would make Descartes a “moderate realist” (Rozemond 2008). One problem with this reading is that it fails to appreciate the full implications of Descartes’ assertion that the essence and existence of any substance are merely rationally distinct. In making this claim, part of what Descartes

is denying is that there are any essences (in God or anywhere else) prior to creation. He makes this negative point explicitly in one of his exchanges with **Burman**, who wondered whether we are right to draw a distinction between essence and existence in all things; and, if so, whether this entails that essence is *prior to* existence; and, if the latter, whether in creating things God merely gives existence to presubsuming essences. Descartes reportedly answers:

We are right to separate the two in our thought, for we can conceive of essence without actual existence, as in the case of a rose in winter. However, the two cannot be separated in reality in accordance with the customary distinction; for *there was no essence prior to existence*, since existence is merely existing essence. *So one is really not prior to the other*, nor are they separate or distinct. (AT V 164, emphasis added)

The “customary distinction” to which Descartes refers is the Thomistic view that there is a real distinction between essence and existence in created things. If essences did exist before created substances, then the real distinction would obtain (at least in the broad sense of a distinction *in* things). But again Descartes maintains that the distinction between essence and existence is restricted to thought or reason, which is why he denies any priority of essences in God’s mind or elsewhere. His view also has the advantage of making sense of the Christian doctrine of creation *ex nihilo*: God creates literally *from nothing*, not from presubsuming essences.

Like the attempt to identify universal essences with divine decrees, Rozemond’s interpretation threatens to saddle Descartes with heresy and to violate the doctrine of divine simplicity. Rozemond and Schmaltz claim that Descartes avoids the heresy charge on their interpretations by distinguishing God’s *causation* of the eternal truths from his *creation* of finite substances – the suggestion being that eternal truths are not creatures in the same sense as minds and bodies (Rozemond 2008, 50, 56; Schmaltz 2004, 83–84). But in one of the passages used to support this distinction, Descartes asserts that God created the eternal truths “†by the same kind of causality† as he created all things, that is to say, as their †efficient and total cause†” (AT I 151–52, CSMK 25) (see Nolan forthcoming). The standard Scholastic solution to the simplicity problem was to say that, before creation, creaturely essences enjoy a nonreal mode of existence in the divine understanding. Because their existence is nonreal, they do not violate God’s simplicity. But Rozemond thinks that Descartes follows Scotus in holding that essences have *a real form of being* in God’s mind, namely, objective being. This claim is much harder to reconcile with divine simplicity, and Scotus himself resorted to his abstruse and controversial notion of a “formal distinction.” Rozemond (2008, 54–55) tries to solve the simplicity problem by saying that for Descartes, unlike Scotus, the

objective beings in God's **intellect** are merely rationally distinct from his essence, but this maneuver attempts to have it both ways: there are diverse essences in God, but they are not diverse!

Descartes understood divine simplicity quite strictly. In several statements of this doctrine, he identifies God's intellect and will and suggests that it is a mistake to conceive of him on the model of a human architect, who must look to ideas or exemplars in his intellect before creation (see, e.g., AT I 149, 151–53, AT VIIIA 14; CSMK 24, 25–26, CSM I 201). That is to anthropomorphize God. So, unlike most Scholastic philosophers, Descartes has no motivation for locating creaturely essences in God, for he rejects the traditional account of creation in terms of exemplary causation. It is natural to wonder how God knows creatures, but Descartes says precious little about this topic, no doubt because he held that God is incomprehensible. But there are reasons for thinking that he was committed to a view like Ockham's, according to which the objects of God's knowledge are not mental entities but created substances themselves (Nolan forthcoming).

The conceptualist interpretation of Cartesian universals has been subjected to objections of its own. While most commentators are no longer inclined to read the Fifth Meditation as endorsing a form of Platonism, some naturally wonder how essences, as innate ideas in human minds, can be "immutable and eternal" (Rozemond 2008; Schmaltz 2014, 210). After all, human souls may be immortal, but they are not eternal; they are also highly changeable. But the difficulty in question may be a function of Descartes' claim that the eternal truths are created, and thus not unique to the conceptualist reading. How can anything created be eternal, especially given the Christian view that creation has a beginning? For theological reasons, one might also hold that eternity in the strict sense is an attribute exclusive to God. These considerations suggest that created essences are "immutable and eternal" only in some deflationary sense. This proposal is encouraged by some of Descartes' early remarks to **Mersenne** where he speaks of "The mathematical truths *which you call eternal*" and "those truths are *called eternal*," which strongly imply that such truths are not literally eternal (AT I 145, CSMK 23; AT II 138, CSMK 103). Jonathan Bennett (1994, 663–65) and Chappell (1997, 126) argue that Cartesian truths are eternal in the same sense that they are immutable, but what sense is that? Descartes takes "true and immutable natures or essences," *qua* ideas, to be inalterable by one's thought. For example, one can think of a triangle at will, but should one notice that it has angles equal to two right angles, one cannot deny or exclude that property. Since the idea is innate, its content imposes itself on one's thought. This account captures the relevant sense of immutability and eternity and complements the conceptualist interpretation (Nolan 1997a).

Another objection to the conceptualist reading is that God's essence cannot be an innate idea in human minds, since God's essence *is* his existence. That would be

tantamount to saying that God himself is merely an idea (Schmaltz 2014, 209–10; cf. Cuning 2003, 239). But here it must be noted that Descartes uses the term “essence” equivocally, whether he is speaking of God’s essence or of finite essences. Sometimes he uses it (1) to refer to an actually existing substance and other times (2) to refer to an innate idea, considered in terms of its objective being, in the minds of human beings. As noted, Descartes thinks that in reality a substance just is its essence (sense 1), but that one can draw a rational distinction in one’s thought between a substance and its essence (sense 2). Since one produces such a distinction by an intellectual abstraction, the essence in question is merely an idea (for further discussion, see Nolan forthcoming).

See also Abstraction versus Exclusion; Attribute; Distinction (Real, Modal, and Rational); Essence; Eternal Truth; Existence; God; Idea; Metaphysics; Mind; Mode; Substance; True and Immutable Nature

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VACUUM

Descartes' view on the vacuum, or void, in nature relied on metaphysical rather than physical considerations. The Scholastic-Aristotelian denial of the possibility of a void had itself rested fundamentally on issues of principle rather than physical contingency, and despite occasional medieval arguments based on **God's** omnipotence, there was in practice little serious Scholastic dispute on the question in Descartes' time. For Aristotle, place and space were interdefinitional concepts: space was always the place of something, and where nothing was in a place, there was no space there to be spoken about (see **place, external versus internal**). Characteristically, Aristotle happily multiplied arguments against void space despite the apparent conclusiveness of this basic metaphysical one in his *Physics* (bks. 4, 7). In discussing the speed of a moving **body**, he associated a higher speed with a greater moving **force**, but also related it inversely (whether strictly or not) to the resistance to **motion**: less resistance, faster motion; greater resistance, slower motion, all other things being equal. This enabled the observation that, counterfactually, if a body moved in a void, which by **definition** exerted no resistance, the body once pushed would move with infinite speed to its terminus. Since the concept of motion was necessarily sequential, as the body moves from its starting point to its end, the idea of an instantaneous translation from start to finish was incoherent. Hence, a medium with no resistance – a void – could not exist.

Descartes' position on this subject broadly resembles the Aristotelian, in that it relies on a metaphysical argument for the void's in-principle impossibility. He holds that matter itself is nothing other than spatial **extension**, on the grounds that this is the only clear and distinct characteristic of matter (see **clarity and distinctness**). If, then, the definition of matter is identical to that of spatial extension, space itself differs in no essential respect from matter; the two are identical. Consequently, a region of space devoid of matter – a void or vacuum – is an impossibility (AT VIIIa 49, CSM I 229–30). Empirical considerations are entirely subsidiary to this argument. In the controversy over the void in the 1640s involving Evangelista Torricelli and **Blaise Pascal**, and focusing especially on mercury barometers, Descartes remains aloof and unconcerned. The space above the mercury could never be truly devoid of matter; consequently it must contain rarefied matter of some kind, and particularly the Cartesian ether, or "second matter," that filled any gaps between bits of "third matter" just as second matter itself is rendered continuous by the flowing into any interstices of Descartes' "third matter" (see **element** and **subtle matter**). His account in both *The World* and the *Principles of Philosophy* of the cosmogenic process that served to explain his three types of matter was premised on the fundamental understanding that, always, wherever there is space, so there is matter. The protean qualities of Cartesian matter ensure that no empirical difficulties with this view could ever arise.

From Descartes' perspective, the only issue that remains to be explained is why we sometimes falsely judge that there are vacua. In *Principles* II.17, he notes that part of the problem stems from a misunderstanding of **language**. Ordinarily, when we say that an object such as a pitcher that is made to hold water is empty, we mean only that it is full of air and thus devoid of the substance for which it is made. But such expressions might lead us to conclude that the pitcher is devoid of any matter whatsoever, a conclusion that is encouraged by relying on our senses. We sometimes infer from the fact that we do not see any extended **substance** in a region of space that the space is empty (AT VIII A 49–50, CSM I 230). This **prejudice** is also encouraged by observing that several objects can come to occupy a given vessel over time. What once contained wine now contains water and so on. If various substances can come to occupy the vessel then, after one body has been vacated, perhaps nothing takes its place, or so one might imagine (AT VIII A 50, CSM I 230).

See also Body; Element; Extension; Place, External versus Internal; Subtle Matter

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PETER DEAR

VANINI, GIULIO CESARE (1585–1619)

Born at Taurisano, Vanini studied **philosophy** in Rome. He studied law in Padua, where he was also ordained a priest. When around thirty years of age, he was accused of atheism, which, in order to clear his name, led him to France. He looks to have avoided prosecution by publishing *Amphitheatrum Aeternae Providentiae Divino-Magicum* (1615). A year later, however, he published *De Admirandis Naturae Reginae Deaeque Mortalium Arcanis* (1616), which resurrected the accusation of atheism. He was arrested in 1618, tried, and condemned to be burned at the stake. He was executed February 9, 1619, at Toulouse.

Vanini's work does not appear to have had any influence on Descartes'. Even so, Descartes mentions Vanini in private **correspondence**; for instance, in a letter to **Isaac Beeckman** (AT I 158, CSMK 27), and again in a letter to **Gysbertus Voetius** (AT VIII B 175, CSMK 223). In the letter to Beeckman, Descartes appears to cast

Vanini in a negative light, listing him among certain philosophers and “innovators,” a list on which Descartes refuses to be cast as a member. In the letter to Voetius, Descartes addresses the former’s comparison of him to Vanini. As Descartes read Voetius, the comparison was supposed to suggest that his work, like Vanini’s, could lead readers to atheism.

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KURT SMITH

VATIER, ANTOINE (1591–1659)

Among the **Jesuits**, Vatier seems to have been one of the persons whom Descartes considered to be the most sympathetic to his **philosophy**. This is the drift of his letter to Vatier of November 17, 1642, where, after having responded to **Pierre Bourdin**’s *Seventh Objections*, Descartes shares with Vatier the wish that “one should abstain from blaming what one does not understand” (AT III 594–97).

Born in Oreilly-le-Tosson, diocese of Séez, on May 19, 1591, Antoine Vatier joined the Society of Jesus in 1613. Just after Descartes’ departure, he studied philosophy at the Collège Henri IV de La Flèche (1615–18) and kept a position as tutor of grammar from 1618 to 1620, then studied theology in the same place from 1620 to 1624, and was professor of **mathematics** from 1624 to 1626. Subsequently he was professor of logic, **physics**, and mathematics in Paris (1626–29), where he had occasion to meet Descartes before the latter’s departure to the Netherlands. He returned

to La Flèche (1630–32 and either 1634–38 or 1634–42) as professor of theology, with an interlude in Bourges to teach logic and physics (1632–34). In the autumn of 1642, he moved to the college in Orléans, apparently because of the *opinionones peregrinae* that he seems to have taught his students. In 1650 he translated and edited the *Spiritual Exercises* of Saint Ignatius of Loyola, a book that enjoyed numerous issues until the end of the seventeenth century. Kept away from teaching, he died in Paris in 1659.

Vatier was among the first to whom Descartes had sent copies of the *Discourse*. He received them very favorably in two letters that are now lost. Descartes' replied on February 22, 1638 (AT I 558–65, CSMK 85–88), finding “as much appreciation as anyone could wish for” (AT II 28 and 661), and answers objections that Vatier had doubtlessly raised while admitting to the “obscurity” and poverty of the proofs for the **existence of God** in *Discourse* IV (AT I 560, CSMK 85–86). He also makes interesting methodological clarifications with respect to his *a posteriori* demonstration of the suppositions of the *Meteors* and the *Dioptrics*. We learn that it was Vatier who imparted to him the desire to see the not-yet-published philosophical foundations of the *Discourse*. Descartes wrote that “he did not miss the opportunity to press me to reveal my physics and my **metaphysics**” (AT II 661), thus intimating that the Jesuits would not communicate their verdict on the *Discourse* and *Essays* before having studied his metaphysics further.

In 1642 Vatier seems to have been privy to the dispute between Descartes and Pierre Bourdin over the Seventh Objections and sent to Descartes a (now lost) letter of support where he stated, among other things, that “I could not help but confess to you that, in view of your own principles, you explain very clearly the mystery of the Holy Sacrament of the Altar, without any entities such as accidents” (AT III 591) (see **transubstantiation**). In Descartes' eyes, Vatier was someone who could help soothe the Jesuits' sensibilities, and in his letter of response, Descartes declared his “veneration and affection” for the Society of Jesus (AT III 594–97). On February 9, 1645, he expressed his wish to inform Vatier of the details of his theory of the Eucharist even while presenting it to **Denis Mesland** (AT IV 170, CSMK 244). And after the publication of the *Principles of Philosophy*, he had a copy sent to Vatier (AT IV 144).

See also Bourdin, Pierre; Jesuit; Transubstantiation

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VLAD ALEXANDRESCU

VILLEBRESSIEU (VILLE-BRESSIEU, OR VILLE-BRESSIEUX), ÉTIENNE DE (CA. 1607–1674)

Villebressieu, who reportedly describes Descartes as “a special friend” (Baillet 1691, 1:258), was a physician, chemist, and engineer of Grenoble. He seems first to have attracted Descartes’ respect for his work with a *camera obscura*, which reversed the image, and suggested an intromissionist theory of **perception**. He spent time in Holland with Descartes, who appreciated his practical ability in following instructions on how to apply prescribed principles and insights, for example, in polishing lenses and mirrors. While with Descartes, Villebressieu worked under him, apparently with success and growing responsibility. Later, he became widely known for his **machines** and inventions, some of which he made during his time with Descartes – for example, a double spiral for scaling a tower, a rolling bridge, and a practical wheelchair. They did much together in **optics**, with Descartes often amazing his pupil with novel effects. Traveling together in Holland, Villebressieu invented a new way of representing complex planar perspectives that promised great savings in time and effort for engineers, painters, and others.

See also Machine, Optics

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THOMAS M. LENNON

VIRTUE

Recent Cartesian scholarship has increasingly been inclining toward the view that Descartes’ ethical writings in his later years deserve recognition as a virtue ethics. While the earlier *morale par provision* in the *Discourse on Method*, part III, lays

the foundations for what would later evolve into Descartes' developed ethics, his full-fledged account of virtue would appear only in the mature ethical writings (notably his 1645–49 **correspondence** and the *Passions of the Soul*[1649]).

Descartes does not disguise the immense influence of the ancient ethicists on his thinking, especially the Stoics. Yet he recurrently conveys his discontent with the Aristotelian, Stoic, and Epicurean treatments of key traditional notions such as “virtue,” “generosity,” “supreme good,” and “**happiness**” and typically imbues them with new meaning. In a letter to **Princess Elisabeth** of August 4, 1645, Descartes presents his own **definition** of “virtue” (*la vertu*) as “a firm and constant resolution to carry out whatever **reason** recommends without being diverted by [one’s] **passions** or appetites” (AT IV 265, CSMK 257–58). Stressing the novelty of his definition, he adds: “Virtue, I believe, consists precisely in sticking firmly to this resolution; though I do not know that anyone has ever so described it. Instead, they have divided it into different species to which they have given various names, because of the various objects to which it applies” (AT IV 265, CSMK 258).

This remark alludes to a paramount feature of Descartes' account of virtue and ethical reasoning, which may be called the “unity of virtue.” Rather than providing a comprehensive set of ideals of character or first-order rules for action to be followed in the various circumstances of our lives, Descartes places at the center of his mature ethical system a single, second-order duty to practice virtue, which he identifies with the good use of the will. In the dedicatory letter to Elisabeth prefacing the French edition of the *Principles*, Descartes writes that all the particular virtues – justice, courage, temperance, and the like – proceed from this single merit of possessing a “firm and powerful resolve always to use [one’s] reasoning powers correctly, as far as he can, and to carry out whatever he knows to be best” (AT VIIIA 1–3, CSM I 191).

For Descartes, the practice of virtue is not simply a means to an end but rather constitutes *itself* our supreme good (*summum bonum*), which he characterizes as “the final end or goal toward which our actions ought to tend” (AT IV 275, CSMK 261. Cf. AT IV 305, CSMK 268; AT V 82–83, CSMK 324–25). He explains to Elisabeth that happiness (*béatitude*) or contentment does not constitute our supreme good but is rather its natural and immediate consequence (AT IV 275, CSMK 261). While aspiring for happiness plays a significant motivational role in our striving for the supreme good, it is virtue itself, not its resulting contentment, that we ought to set ourselves as our highest *moral* end (AT IV 275, 277, CSM I 261, 262; AT V 83, CSMK 325). Yet, since the mind’s self-contentment or happiness is always in proportion to the greatness of the good it consciously possesses, the exercise of virtue as the greatest of all our goods is indeed the source of our greatest happiness (AT V 84–85, CSMK 325–26).

To support this view, Descartes introduces to **Queen Christina** his main criterion for identifying something as good: “We should not consider anything as good,

in relation to ourselves, unless we either possess it or have the power to acquire it” (AT V 82, CSMK 324). Since the only thing absolutely “within our disposal” and entirely dependent on us is our **free will**, a firm will to do well is our supreme good, the greatest perfection we can attain (AT V 82–83, CSMK 324–25). Underlying this view is the doctrine that our free will constitutes the most prominent mark of our likeness to **God**. As Descartes concludes, “Free will is in itself the noblest thing we can have, since it makes us in a way equal to God and seems to exempt us from being his subjects; and so its correct use is the greatest of all the goods we possess” (AT V 85, CSM I 326). On these grounds, Descartes maintains that all the concrete goods we can attain are to be valued not for themselves but according to the extent to which they can be acquired through the exercise of virtue or, what comes to the same, the good use of the will. And since we cannot be praised or blamed except for what depends entirely on us, on our free will, the practice of virtue *qua* the good use of the will is also the only thing that deserves praise and glory: “I shall not hesitate to express my opinion that nothing except virtue really deserves praise. All other goods deserve only to be esteemed and not to be honoured or praised, except in so far as they are supposed to have been acquired or obtained from God by the good use of free will” (AT V 84, CSMK 325).

Descartes repeats the preceding definition of virtue in a letter to Elisabeth, describing it as “a firm and constant will to bring about everything we judge to be the best, and to use all the powers of our **intellect** in judging well” (AT IV 277, CSMK 262). Likewise, he writes to Queen Christina that to pursue virtue is to hold “a firm and constant resolution to carry out to the letter all the things which one judges to be best, and to employ all the powers of one’s **mind** in finding out what these are” (AT V 83, CSMK 325. Cf. AT IV 284, CSMK 263).

To exercise virtue, as these passages indicate, one must meet two principal conditions. The first is to strive to judge well, namely, to use all the powers of one’s intellect to find the best course of action to pursue. The second condition is to execute resolutely and firmly whatever course of action we have decided to follow relying on our best available **knowledge**. In a letter to Queen Christina, Descartes emphasizes the internal connection between wisdom and resolution as two necessary conditions for virtue. In pursuing virtue, our resolution must not stem from mere stubbornness but from our conviction that we have done our utmost to reach the best **judgment** available under the circumstances (AT V 83–84, CSMK 325). Yet, to judge well in the conduct of life and thereby meet the first condition of virtue, we need not judge indubitably and infallibly. Even when we fail to choose what is best, we can still be virtuous provided that, when making our decision, we strive to employ our mind in the best possible manner so as to reach the best judgment available and act resolutely on it. Only then can we “be sure of having done our duty” and consequently be absolved of feelings of guilt and regret, even when our judgment turns out to be false (AT V 83–84, CSMK 325; cf. AT IV 307, CSMK 269).

Descartes' nonconsequentialist account of virtue is intended to guide us on the good use of the will in practical matters wherein absolute **certainty** is often unattainable. On his account, actions are good or bad depending on how they are chosen and accomplished, not on their intrinsic features or ensuing consequences. This nonconsequentialist approach is also present in the *Passions of the Soul*, where Descartes states that "we always do our *duty* when we do what we judge to be best, even though our judgment may perhaps be a very bad one" (AT XI 460, CSM I 391; emphasis added). Descartes' use of the term "duty" (*devoir*) when speaking of the exercise of virtue is in line with the obligatory language he employs when equating virtue with our supreme good, describing it as "the final end or goal towards which our actions *ought* to tend" (AT IV 275, CSMK 261; emphasis added). The normative import of these statements should be read against the wider background of the status that Descartes' later writings accord to the good use of the will, considering it a binding moral command of **reason** that we *ought* to obey for its own sake and that exclusively determines our moral worth. Descartes' peculiar virtue ethics thus comprises a distinctive deontological dimension (see Naaman-Zauderer 2010, 178–204).

In the *Passions of the Soul*, Descartes expounds on the idea that the key to our virtuousness and happiness is to wield power over our passions and not be enslaved by them. Our main task as moral agents is to channel our desires to things depending entirely on our free will, things that deserve to be pursued (AT XI 436–37, CSM I 379). Since the pursuit of virtue consists in doing the good things that depend entirely on us, our knowledge of their goodness ensures that we cannot desire them with too much ardor (AT XI 436–37, CSM I 379). And since the passions prompt us to action by means of the desires they produce, "it is this desire which we should take particular care to control; and here lies the chief utility of morality" (AT XI 436, CSM I 379).

For Descartes, the key to mastery of the passions lies in the knowledge of their **causes** (Alanen 2003, 178). The moral therapy that he sets forth in the *Passions of the Soul* is thus anchored in his antecedent analysis of the psychophysical mechanism that yields various passions in the soul. Descartes defines the passions as bodily dependent mental states arising in the soul by cerebral movements that are transmitted to the **pineal gland** through some agitation of the **animal spirits** – without the concurrence of the will (AT XI 349, CSM I 388–39). While confident that even the weakest souls can acquire absolute mastery over their passions in the pursuit of virtue, by employing proper guidance and training (AT XI 368–70, CSM I 348), Descartes is skeptical about the power of the soul to exert *direct* control over its passions. Owing to their bodily origin, the passions cannot be directly aroused or suppressed by a mere exercise of the will but only indirectly, "through the representation of things which are usually joined with the passions we wish to have and opposed to the passions we wish to reject" (AT XI 362–63, CSM I 345). Descartes appears to be addressing here his "principle of

habituation,” which he considers “the principle which underlies everything I have written about [the passions]” (AT XI 428–29, CSM I 375. Cf. AT XI 369–70, CSM I 348). Whenever nature or **habit** joins certain brain movements to certain thoughts, we can change these well-established associations (and their resulting patterns of emotional response) by habituating ourselves to associate these brain movements with other thoughts we find more desirable. We can initiate this process by inquiring into the cause of the particular passion we wish to suppress while habituating ourselves to believe that only those things whose acquisition depends entirely on our free will deserve to be pursued.

Descartes proceeds to offer two general remedies for “vain” desires, directed to objects beyond our power. Both remedies are intended to help us accustom ourselves to desire only things within our dominion and thereby acquire a *habitual desire for virtue*, for the good use of the will. The first remedy is frequent reflection on divine Providence, and the second is generosity (*générosité*). Descartes believes that frequent reflection on the necessity with which God has determined all things to happen from all eternity may strengthen our recognition that external things are beyond our control (AT XI 438, CSM I 380). But to acquire a *habitual* desire for virtue, we must esteem ourselves in a justified manner, in accordance with our true value (AT XI 445–46, CSM I 384; AT XI 452–54, CSM I 387–88). This legitimate self-esteem consists in generosity, the second remedy for vain desires that Descartes counts as both a passion and a virtue (AT XI 451, CSM I 386), indeed, the crowning virtue: “the key to all the other virtues and a general remedy for every disorder of the passions” (AT XI 454, CSM I 388).

In the *Passions of the Soul*, part III, Descartes defines true generosity as having two components. The first, cognitive, component consists in one’s “knowing that nothing truly belongs to him but this freedom to dispose his volitions, and that he ought to be praised or blamed for no other reason than his using this freedom well or badly” (AT XI 446, CSM I 384). The second, affective, component consists in one’s “feeling within himself a firm and constant resolution to use it well – that is, never to lack the will to undertake and carry out whatever he judges to be best. To do that is to pursue virtue in a perfect manner” (ibid.). The close kinship between the two components is evident. To acquire a habitual desire for virtue, we must first obtain a proper understanding of the invaluable merit of our free will and of the manner in which it determines our moral worth. Besides our metaphysical knowledge of the nature and value of our free will, this understanding involves our self-evident experience of freedom (Shapiro 1999, 249–58), which makes us conceive of ourselves as godlike. Only on account of this self-knowledge can we feel ourselves committed to firmly and constantly using this power well, as the second component requires. The passion of generosity – the *feeling* within ourselves of a firm and constant resolve to practice virtue through the good use of the will – becomes a particular virtue on its own when we develop it into a **habit**, a habitual passion to use free will well

(Naaman-Zauderer 2010, 198–200. Cf. Shapiro 1999; Alanen 2003, 251; Brown 2006, 188, 191).

Descartes holds that generosity causes us to esteem ourselves in a justified manner, in accordance with our true value (AT XI 453, CSM I 388), for the only thing that can justify our self-esteem is our good use of the will, the highest attainable perfection (AT XI 445–46, CSM I 384). Esteem is a species of wonder, which in turn is one of the three primitive passions that constitutes the passion of generosity: the passion of wonder (directed at our “marvelous” power to use free will well, which causes us to value ourselves in a justified manner), the passion of joy (that results from the same cause as our self-esteem), and the passion of love (self-love, which has its origin in our good use of the will) (AT XI 451–53, CSM I 387). Descartes believes that, in forming our esteem for ourselves, the virtue of generosity also forms our esteem for others. Those who possess this knowledge and this feeling about themselves, he writes, never have contempt for anyone, for they “readily come to believe that any other person can have the same knowledge and feeling about himself, because this involves nothing which depends on someone else” (AT XI 446, CSM I 384). Generous individuals are thus disposed to have esteem for others because they recognize the free will found in all human beings, which makes them equally capable of attaining the habit of using this power well.

Descartes’ account of generosity conveys the indispensable role that the passions, when properly tamed, play in our moral and intellectual growth. To be disposed to act virtuously, on both the practical and intellectual domains, we need not detach ourselves from our passionate dispositions but rather acquire a habitual desire for the good use of the will. When dealing with intellectual judgments in the Fourth Meditation, Descartes accordingly asserts that acquiring “the habit of avoiding error” (i.e., the habit of using free will well by suspending judgment whenever a distinct perception is lacking) is “man’s greatest and most important perfection” (AT VII 62, CSM II 43). In both realms, *mutatis mutandis*, our understanding of the value of our free will is strengthened by the movements of the animal spirits and evolves into a habitual resolve to use free will well.

It now becomes clear why generosity is, for Descartes, the highest virtue, “the key to all the other virtues and a general remedy for every disorder of the passions” (AT XI 454, CSM I 388). Whereas all the particular virtues are reduced to the good use of the will (which is the practice of virtue in Descartes’ peculiar sense), the virtue habit of generosity forms our proper attitude toward the practice of virtue itself and, through it, toward ourselves. Being disposed to feel within oneself a firm and constant resolve to use free will well, the generous agent enjoys enduring happiness – a steadfast peace of mind or “tranquility.” To be immune to the disturbances of the passions, the soul “should have the means of happiness” within itself, for which it needs “to pursue virtue diligently.” Once this condition obtains, “all the troubles coming from elsewhere are powerless to harm it. Such troubles will serve rather to

increase its joy; for on seeing that it cannot be harmed by them, it becomes aware of its perfection" (AT XI 442, CSM I 382).

See also Animal Spirits; Christina, Queen of Sweden; Elisabeth, Princess of Bohemia; Free Will; Habit; Happiness; Judgment; Passion; *Passions of the Soul*; Pineal Gland

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VOETIUS, GYSBERTUS (1589–1676)

Gysbert Voët (he Latinized his name as soon as he became a professional) was born at Heusden, a garrison town on the border with the Spanish Low Countries. During his theological studies at Leiden, he became involved with the Contra-Remonstrants, the ultra-orthodox wing of the Dutch Reformed Church, which adhered to a strong interpretation of predestination. After his studies he was minister in various places before being appointed (1634) professor of theology at Utrecht Illustrious School, which in 1636 was elevated to the rank of university. A learned and industrious man rather than an original scholar, he soon became one of the pillars of orthodox theology, publishing almost ten huge volumes of disputations and several books on practical theology, as well as preaching and fighting on many fronts: against relaxed variants of Protestantism (like Arminianism and Coccejanism), but also against Catholicism, libertinism, Socinianism, **Cartesianism**, and atheism. Moreover, he vociferously intervened against practical and social evils, like the theater, the desecration of the Sabbath, usury, and the worldly use of ecclesiastical goods. In his later career, he more and more emphasized the need of personal piety, consisting in a rigorous obedience to the will of **God** in combination with ascetic practices.

Like other orthodox theologians of his age, Voetius had a complex relation to **philosophy**. On one hand, he emphasized the absolute clarity of scripture, which moreover enjoyed an authority superior to any human **truth**; on the other hand, he felt that philosophy was indispensable in order to establish its true meaning. The solution of this paradox was to declare that “sound philosophy” is no more than a sophisticated form of common sense. Hence, he had a deep distrust in purely intellectual speculation. It is against this background that his reaction to Cartesianism must be interpreted. At Utrecht University, Cartesian philosophy was explicitly introduced in 1638 by the professor of theoretical medicine **Henricus Regius**, a friend of Descartes. Regius favored an aggressive approach, which in 1641 led to a confrontation with the theologians. They felt that several of Regius’s ideas (on **human beings**, on **the motion of the earth**, on **substantial forms**) were a threat to systematic theology; they did not like the polemical way in which Regius presented his ideas; and they had no confidence in a philosophy of which no more than a few fragments were known and which as yet was not taught at other universities. Accordingly, they considered a public declaration to the effect that Regius’s ideas were conducive to atheism. After an intervention by the town’s burgomaster, they scaled down their protest. Voetius, however, obtained permission to discuss the issues involved in a disputation on **substantial forms**, which was held on two consecutive days in December 1641. After some hesitation, Descartes encouraged Regius to write a reply, a large part of which he dictated himself. It was published in February 1642. Despite the fact that the tone was on the whole courteous, some elements proved to be injurious,

especially the suggestion that, instead of giving support to orthodox religion, the doctrine of substantial forms undermined it. Voetius was furious. The town administration, also the ruling body of the university, and the professors of other faculties were angry because in their view Regius's pamphlet broke a fragile and hard won peace. As a result, Voetius, at the time *rector* of the university, easily found a majority to endorse an official judgment, in which Regius's behavior was blamed. The "new philosophy" was condemned and its teaching prohibited. Moreover, the administration decided to relegate Regius entirely to the medical faculty and to deprive him of the right to teach general courses on **physics**.

Now it was Descartes' turn to be furious. He used the delay in the printing of the second edition of the *Meditations* (1642) to add a *Letter to Father Dinet*, general of the **Jesuits** in Paris, the second half of which he completely devoted to the Utrecht crisis. Not only did he sketch a vitriolic portrait of Voetius, but he also attributed the official judgment to Voetius, who would have used his position as rector to take personal revenge. **Martin Schoock**, professor of philosophy at Groningen, was ready to take Voetius's defense and publish a general assessment of Cartesian philosophy. However, before the printing of Schoock's book was finished, Descartes got hold of the first printed sheets and started to work on a reaction, which took the form of an open *Letter to Voetius* (1643), published almost simultaneously in Latin and Dutch. In this work he broadened the scope of his attack by including a discussion of Voetius's conflict with another Calvinist minister, Samuel Maresius (1599–1673), the issue being whether Protestants may become member of a corporation dedicated to the Virgin Mary. Moreover, he criticized Voetius's prophetic style of preaching as a social evil, meant to mobilize the lower classes against the worldly authorities. Against his better judgment, Descartes took it for granted that not Schoock but Voetius was the author of Schoock's book, *Admiranda methodus philosophiae cartesianae* (Utrecht 1643). Offering it to Utrecht municipal government, he implicitly urged it to deprive Voetius of his public position. However, a committee concluded that not Voetius but Descartes should be criminally prosecuted. Meanwhile, Descartes turned to Groningen to lodge a complaint against Schoock. In a highly ambiguous way, Schoock explained his role as being subordinate: all he had done was to organize the materials supplied by Voetius and his friends. Armed with that declaration, Descartes went back to Utrecht. Although thanks to a personal intervention of the stadholder, the procedure against him had been halted; he asked that it be resumed, given the fact that Schoock's confession, which had been accepted by Groningen University, made it clear that he had been right all the time. But no Utrecht official wanted to heed this request, afraid that reopening the conflict would threaten the delicate balance between the civil authorities and the church. Descartes' final request to reopen his case, the *Lettre apologétique aux magistrats d'Utrecht* (1647), was simply ignored.

See also Dinet, Jacques; Jesuit; Regius, Henricus; Schoock, Martinus

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THEO VERBEEK

VORSTIUS, ADOLPH (1597–1663)

Born in 1597, the son of a Leiden professor of **medicine**, Vorstius (Voorst) studied humanities at Leiden University before embarking on a European tour ending in Padua, where he obtained a degree in medicine. In 1625 he succeeded his father as professor of medicine and director of the botanical garden at Leiden. In that capacity he published catalogs of the plants growing in the botanical garden (1633) as well as an edition of the *Aphorisms* of Hippocrates (1628). Never a very active scholar, he was often reprimanded by the university administration for neglecting his classes. No more than one letter of Descartes to Vorstius survives. It contains a full exposé of Descartes' theory of **animal spirits** (June 19, 1643; AT III 686–89). There must have been personal meetings as well; in a letter to De Wilhem, Descartes refers to a dinner party he attended at Vorstius's house (May 24, 1647; AT V 33). Moreover, Descartes' letter shows that Vorstius also took the former's defense, probably in the assembly of Leiden professors. Vorstius left hardly any writings, so it remains unknown whether he was sympathetic to Descartes' medical and physiological ideas.

See also Animal Spirits, Medicine

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THEO VERBEEK

VORTEX

The theory of vortical celestial **mechanics**, as presented in the *Principles of Philosophy* and *The World*, is the “engine room” of Descartes’ system of natural philosophy. Descartes starts his vortex theory with an “indefinitely” large chunk of divinely created matter or **extension** in which there are no void spaces whatsoever. When God injects **motion** into this extension, it is shattered into microparticles, and myriads of “circular” displacements ensue, forming gigantic whirlpools or vortices. This process eventually produces three species of corpuscle, or **elements**, along with the birth of stars and planets. The third element forms all solid and liquid **bodies** on all planets throughout the cosmos, including the earth. Interspersed in the pores of such planetary bodies are the spherical particles of the second element. The second element also makes up the bulk of every vortex, while the spaces between these spherical particles are filled by the first element, which also constitutes the stars, including our sun.

The key to Descartes’ celestial mechanics is his concept of the “massiveness” or “solidity” of a planet, meaning its aggregate volume to surface ratio, which is indicative of its ability to retain acquired motion or to resist the impact of other bodies. The particles of the second element making up a vortex also vary in volume to surface ratio with distance from the central star, as gathered from Descartes’ stipulations concerning the variation of the size (and speed) of the second-element particles with distance from the central star (Figure 32). Note also the important inflection point in the size and speed curves at radius K (Schuster 2005, 49). A planet is locked into an orbit at a radial distance at which its centrifugal tendency, related to its aggregate solidity, is balanced by the counter **force** arising from the centrifugal tendency of the second-element particles composing the vortex in the vicinity of the planet – that tendency similarly depending on the volume to surface ratio of the those particular particles.

The most massive planet in a star system will be closest to, but not beyond, the K layer – as Saturn is in our planetary system. Comets are planets of such high solidity that they overcome the resistance of the second-element particles at all distances up to and including K. Such an object will pass beyond the K level, where it will meet second-element particles with decreasing volume to surface ratios, hence less resistance, and be extruded out of the vortex into a neighboring one. Entering the neighboring vortex, the comet falls, and spirals, downward toward its central star, all the time meeting increasing resistance from the second-element particles above that vortex’s K distance. As it picks up increments of orbital speed, the comet starts to generate increasing centrifugal tendency, begins to rise and spiral upward, and eventually is flung back out of the second vortex.

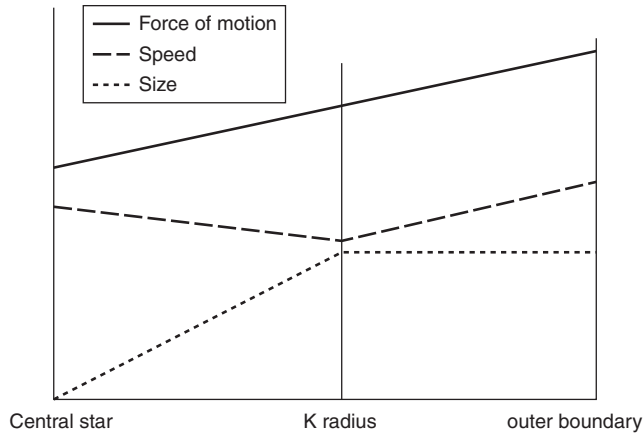


Figure 32. Size, speed, and force of motion distribution of particles of the second element in a stellar vortex (*Source*: John Schuster).

Also essential to Descartes' theory is a principle of vortex stability, which he introduces using his ideas about the dynamics governing the motions of corpuscles (see **light**). In the early stages of vortex formation, before stars and elements have evolved, the then existing vortical particles become arranged so that their centrifugal tendency increases continuously with distance from the center (AT XI 50–51, G 33). As each vortex settles out of the original chaos, the larger corpuscles are harder to move, resulting in the smaller ones acquiring higher speeds. Hence, in these early stages, the size of particles decreases and their speed increases from the center out. But the speed of the particles increases proportionately faster, so that force of motion (size times speed) increases continuously. Figure 33 shows the distribution of size and speed of the particles in any vortex before a central star, and the three elements have formed (Schuster 2005, 46).

Stars do not exist in the early stages of vortex formation as described by Descartes. They form in the center of each vortex as part of the process leading to the emergence of the three final Cartesian elements. Every star alters the original size and speed distribution of the particles of the vortex, in a way that now allows planets to maintain stable orbits. Descartes explains that a star is made up of the most agitated particles of the first element. Their agitation, and the rotation of the star, communicate extra motion to particles of the vortex near the star's surface. This increment of agitation decreases with distance from the star and vanishes at that key radial distance, called K (Figure 34) (AT XI 54–56, G 35–7; Schuster 2005, 48).

This stellar effect alters the original size and speed distribution of the spheres of the second element in the vortex, below the K layer. There now are greater corpuscular speeds close to the star than in the prestar situation. But the all-important

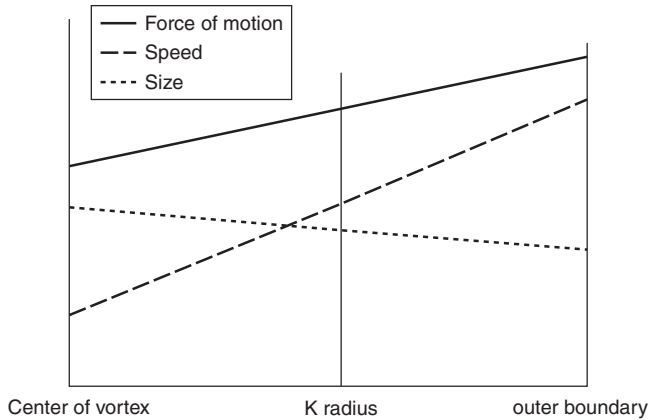


Figure 33. Size, speed, and force of motion distribution of particles of the second element, prior to existence of central star (Source: John Schuster).

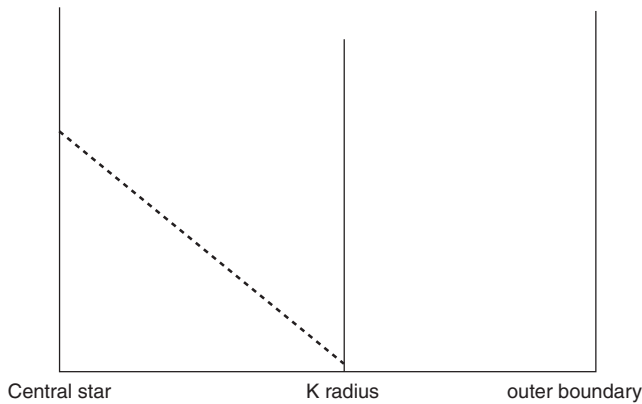


Figure 34. Agitation due to existence of central star (Source: John Schuster).

vortical stability principle still holds, so the overall size/speed distribution must change, below the K layer. Descartes ends with the situation in Figure 32, with the crucial inflection point at K. Beyond K we have the *old* (prestar formation) stable pattern of size/speed distribution; below K we have a *new* (poststar formation), stable pattern of size/speed distribution. This new distribution turns a vortex into a **machine**, which, as described, *locks* planets into appropriate orbits below K and *extrudes* comets into neighboring vortices. In this way Descartes follows Johannes **Kepler**'s lead in attempting to theorize about the physical role played in celestial mechanics by the sun, or any central star in a planetary system. Copernicus himself had never raised the issue of the sun's causal role in planetary motion.

In its intimate technical design, Descartes' vortex mechanics is a science of equilibrium, resembling his work on **hydrostatics** in his early program in **physico-mathematics** (Gaukroger and Schuster 2002; Gaukroger 2000; Schuster 2005). The forces at work on a planet can be fully specified only when orbital equilibrium has been attained, although of course no actual measurements are involved. The radial movement of a planet or comet (its rise or fall in a vortex) results from the breakdown of equilibrium and cannot be defined mathematically. Despite this limitation, Descartes intended that his theory of vortices qualitatively unify the treatment of celestial motions and the phenomena of local fall and of planetary satellites. A comet extruded from one vortex enters a neighboring one and falls toward its K layer before picking up centrifugal force and rising again out of the vortex in question. Similarly, Descartes makes it clear that a planet "too high up" in the vortex for its particular solidity is extruded sun-ward, falling (and spiraling) down in the vortex to find its proper orbital distance (AT XI 65–66, G 42; AT VIII 193, MM 169). In exactly the same fashion, Descartes' theory of local fall (AT XI 73–74; G 47) and theory of the orbital motion of the moon, when taken in their simplest acceptations, both also make use of the notion of falling in a vortex until a proper orbital level is found (with the assumption that no other circumstances prevent completion of the process, as they do in local fall of heavy terrestrial bodies near the surface of the earth). However, Descartes' treatment of locally falling bodies and the motion of satellites both run into considerable difficulties when he attempts to explicate them in detail (see **gravity**).

Taken in both its technical details and its qualitative sweep, Descartes' vortex theory was a considerable achievement. The theory signaled Descartes' commitment to the truth of Copernicanism writ large, as an account of innumerable star and planet systems – interlocking subsystems in the great **machine** of nature. He prefigured **Newton** in trying to bring planets, comets, satellites, and locally falling bodies within one explanatory web, and his vortex theory persisted into the eighteenth century to compete with Newton's **physics** (Aiton 1972).

See also Cosmology; Earth, Motion of the; Element; Force and Determination; Gravity; Hydrostatics; Light; Mechanics; Physico-Mathematics; Physics

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JOHN A. SCHUSTER

WAX

In the Second Meditation, after achieving his first piece of **certainty**, that of his own **existence** as a thinker, Descartes' meditator allows his **mind** to relax and return to its old **habit** of trusting the senses to give him information about what exists in the world around him and about the nature of such things. What he first attends to is a piece of wax, fresh from the honeycomb and still retaining the scent of the flowers the bees had visited. It is white and solid, but when put by the fire it becomes liquid and transparent and can be formed into countless **shapes**. The senses of sight and touch inform us only of its temporary states, and even **imagination** cannot cover all its possible shapes. It is **intellect** or **reason** that tells us what is always true of it – namely, that is an extended, flexible, and changeable thing – just as it was reason that assured him that he was a thinking thing with countless changing **thoughts**.

Although the wax is contrasted with himself, since its existence is not certain yet, it also gives him a model for himself, and the passage prepares us for the claim in the Sixth Meditation that there are just two sorts of finite **substance**, thinking substance and extended substance. The wax is his first sample of extended substance, where **extension** is true of it throughout its changes, just as **thought** is true of himself throughout all his ever-changing conscious states. The implicit comparison between his mind, with its countless thoughts, and the wax, and its countless shapes, makes the wax a sort of image of himself. "Is it not the same 'I' who is now doubting almost everything, who nonetheless understands some things, who affirms that this one thing is true, desires to know more, is unwilling to be deceived, imagines many things even involuntarily, and is aware of many things which apparently come from the senses?" (AT VII 28, CSM II 19). Later he adds:

But even as I speak I put the wax by the fire, and look: the residual taste is eliminated, the smell goes away, the colour changes, the shape is lost, the size increases; it becomes liquid and hot; you can hardly touch it, and if you strike it, it no longer makes a sound. But does the same wax remain? It must be admitted that it does; no one denies it, no one thinks otherwise. (AT VII 30, CSM II 20)

In his reply to the Third Objections, he says: "All I proved with the example of the wax was that colour, hardness and shape do not belong to the formal concept of the wax itself. I was not dealing in that passage with the formal concept of the mind, or even with that of the body" (AT VII 175, CSM II 124). This makes it sound as if it was the formal concept of the wax he was after, but there was no talk of any formal concepts or of essences in the discussion of the wax. He certainly did not there arrive at the **essence** of the wax as such, since what he says of it, that it is always flexible, changeable, and extended, is equally true of many other sorts of material substance.

Still, he did prepare the way for taking the concept of extension as a determinable, like that of thought, and one that could be used to define what matter, as distinct from mind, has as its essence. Flexibility too seems restricted to physical things, but changeability is true of any substance with duration and changing **modes**. These three **attributes** tell us about the nature of the wax but do not give its essence. (Presumably it would take a chemist to tell us that.)

What he says he has learned from his loosening of the reins of the mind to attend to the senses and consider the wax is that it takes intellect to discern the “naked wax,” to see distinctly what is true of it throughout its changes, and also he has learned that mind is more easily known than **body**, since every tentative finding about the wax gives him a new truth about himself, namely, that he has reached that finding. So he has far more truths about himself and his changes than he has about the wax, since few of the truths about his thoughts yield any **truth** about the wax.

In the last paragraph of the meditation he says he has arrived where he wanted to be – realizing that “even bodies are not strictly perceived by the sense or the faculty of the imagination, but by the intellect alone ... and in view of this I know plainly that I can achieve an easier and more evident **perception** of my own mind than of anything else” (AT VII 34, CSM II 22). So loosening the reins all along had an ulterior purpose, to confirm what had been concluded when the reins were tight, that his first **knowledge** is of himself, and is reached by intellect.

The discussion of the wax confirms earlier findings and prepares the way for the later findings about extension as the essence of material things. The third important thing it does is introduce the notion of the distinctness of an **idea** (see **clarity and distinctness**). The relatively distinct idea of what remains true of the wax throughout its changes is reached by intellect, while the sensory ideas of its temporary states are deemed indistinct, although once he thought them quite distinct. Are they deemed indistinct because they are true of it only briefly? Were his ideas of particular thoughts indistinct because they were only passing thoughts? It is introspection, not the senses that give us awareness of what we are now thinking, and intellect came in only to discern that conscious thinking is what is true of all of them. He uses the term “mental scrutiny” to span both intellection and introspection, and he does not call his idea of what he is currently thinking indistinct, unless he is having an idea of a secondary quality. Yet ideas of what we are thinking are as temporary as are ideas of the momentary states of the wax.

The wax passage is the first in which the concepts of clarity and distinctness are used, but it leaves us unclear if the idea of a temporary state, of wax or of a mind, can achieve distinctness, perhaps when shown as a mode of its essence. He does not give us a **definition** of clarity and distinctness until *Principles* I.45, but his first examples of *relative* distinctness, and *relative* clarity, occur here in the discussion of the wax. He begins by saying that in his uncritical days he thought that what the senses perceive is more distinct than anything else, so distinctness is not so easily recognized. He can

be wrong about what idea is more distinct than another. That his idea of **God** be clear and distinct is important in the Third Meditation, and the Fourth Meditation establishes that if he affirms only those ideas which are clear and distinct, he will not err (see **error, theodicies of**). It is distinctness, not clarity, that his idea of the wax is first said to attain, after the intellect has seen what is always true of it, but later he speaks of both the clarity and the distinctness of the idea attained. By the *Principles*' definitions, distinctness presupposes clarity, so after establishing the distinctness of his final idea of the wax, he had also established its clarity. His final idea of the wax is more distinct than his initial idea of it, but it is not fully distinct since he has not found what makes wax a distinctive sort of material thing, what "is so sharply separated from all other perceptions" as the *Principles* definition requires. Thereafter in the *Meditations*, until he comes in the Sixth Meditation to discuss our ideas of pain and of secondary qualities, which can be clear but not distinct, clarity and distinctness accompany each other. The main role of the discussion of the wax is to accustom us to these important notions, but it also prepares us for the later discussion of extension as the essence of all material things.

See also Clarity and Distinctness; Essence; Extension; Idea; Intellect; Knowledge; Mind; Sensation; Thought

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ANNETTE BAIER

THE WORLD (OR TREATISE ON LIGHT)

As a result of his alarm at the outcome of **Galileo's** trial, Descartes decided not to publish the manuscript of *Le monde* he had planned to offer as a New Year's gift to his friend **Marin Mersenne** at the start of 1634. Though not yet finished at the end of

1633, the publication we now know under the English title as *The World*, or *Treatise on Light*, reads as a fully developed text in itself. *Le monde* is written in a style much lighter than either the *Rules for the Direction of the Mind* or Descartes' other early texts and echoes the thrill and enthusiasm with which its author had developed a revolutionary line of thought after initially having embarked on the **explanation** of a set of meteorological phenomena in 1629.

In the spring of that year, the German Jesuit Christoph Scheiner (1573–1650) had made some precise observations of the occurrence of no less than five parhelia, or sundogs, at Frascati, near Rome. Through Nicolas-Claude Fabri de Peiresc (1580–1637) and **Pierre Gassendi** (1592–1655), Scheiner's description was handed down to Henri Reneri (1593–1639) (see **Reneri, Henricus**), the Walloon professor of philosophy whom Descartes had followed to Deventer and Utrecht. In October, Descartes decided not only to explain this phenomenon but to write a full treatise on meteorology. Within a month, he had abandoned this plan, too, and was preparing a complete **physics** on all natural phenomena. As Descartes would later explain in the *Discourse on Method* (AT VI 41–42, CSM I 132), his account of the nature of **light** served him as a central theme to which other subjects could be related. For the original treatise, he developed not only the subjects we now find in *The World*, such as the origin of heavenly **bodies** from elementary particles, their orbits, and the explanation of **gravity**, but also topics that he would later incorporate in the text of the *Principles of Philosophy*, such as his explanation of the tides.

Having abandoned his former conviction that **knowledge** is somehow structured along the lines of geometrical intuition and **imagination**, Descartes, on his return to the Netherlands, nevertheless stuck to another line of argument from the *Rules*: the idea that true knowledge is based on the use of “**simple natures**” on account of which different things may be related to each other. In **metaphysics**, this idea led to a new focus on the epistemological contingency that holds between the understanding and the world, and on the role of **God** in aligning the human **mind** to nature. In physics, it brought to fruition Descartes' earlier proposal to explain natural processes by means of “familiar entities” such as “**extension, shape, motion**, and the like” (AT X 439, CSM I 57).

Accordingly, *The World* introduces a whole range of ideas essential to the mechanical philosophy: the notion that all natural processes are reducible to mechanisms at the level of fundamental particles; the view that the use of such models of “matter in motion” uniquely meets the philosophical requirement of explanatory efficiency; and the accompanying notion of “**laws of nature**” with which to describe the regular behavior of parts of matter. In *The World*, Descartes thus for the first time elaborated in considerable detail two views that have since remained crucial to physics and **cosmology**: the idea that all natural phenomena have ultimately to be explained at the level of fundamental particles (what we might call the “vertical axis”

of the reductive explanation) in combination with the idea that the present state of things in the universe has to be seen as the effect of previous stages of development (the “horizontal axis”).

From a broader cultural perspective, *The World's* hypothetical use of an evolutionary model of the universe might with hindsight be regarded its most revolutionary concept. However, apart from an alleged discussion with Anna Maria van Schurman on the scientific relevance of the book of Genesis (AT IV 700–1), the conflict between a philosophical reconstruction of the evolution of the natural world and the biblical account of the six days of creation did not lead to any significant debate – not even when Descartes later included his famous “fable” in the text of the *Principles*. Nor was the fable itself – the “Description of a new world” – intended as a disguised way of presenting new ideas about the real world. Descartes simply argued that the truth would come out more elegantly and more clearly if he could show how a world like ours could be reconstructed on the basis of the two concepts of matter and motion alone. In the *Discourse*, he would again use the term “fable” (AT VI, 4) in order to introduce a looser style of writing in which the **truth** might nevertheless become manifest.

Instead of a conflict between the Bible and physics, two other themes mark the crossroads that *The World* forms within the history of ideas: the epistemological question of the difference between things as they are in themselves and our experience of them, and the metaphysical question concerning the principles of **individuation** and change. Descartes expressly addresses the first question right at the start of the text of *The World*, offering various arguments and analogies to argue that there is a “difference between our **sensations** and the things that produce them” (AT XI 3, CSM I 81). Presumably in order not to break the peace with “the philosophers,” the second question is never expressly addressed, although it looms large on every page of the treatise. Descartes allows himself to ignore metaphysical questions because he is confident that his mechanistic explanations make redundant all discussion of real qualities and substantial forms (AT XI 7, 25–26; CSM I 83, 89) (see **form, substantial** and **quality, real**). Accordingly, whereas readers of the *Treatise on Man* could not fail to notice the disappearance of the Aristotelian concept of the soul from Descartes’ mechanical explanations of bodily processes, it is in an implicit way only that readers of *The World* witnessed a parallel disappearance of substantial forms from nature.

See also Cosmology; Explanation; Form, Substantial; Galilei, Galileo; Law of Nature; Light; *Meteors*; Motion; Physics; Quality, Real; *Treatise on Man*

FOR FURTHER READING

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